



Silicon-Organic hybrid Fabrication platform for Integrated circuits

Final report on SOFI dissemination and promotion activities

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List of Partners concerned

Partner number	Partner name	Partner short name	Country	Date enter project	Date exit project
1 (coordinator)	Karlsruhe Institute of Technology (formerly University of Karlsruhe)	KIT	Germany	M1	M42
2	SELEX - Sistemi Integrati	SELEX	Italy	M1	M42
3	Interuniversity Microelectronics Centre - IMEC	IMEC	Belgium	M1	M42
4	Rainbow Photonics AG	RB	Switzerland	M1	M42
5	GigOptix-Helix AG	GO	Switzerland	M1	M42
6	Research and Education Laboratory in Information Technologies	AIT	Greece	M1	M42
7	The University of Sydney, Centre for Ultrahigh bandwidth Devices for Optical Systems	CUDOS	Australia	M1	M42

¹ PU = Public

PP = Restricted to other programme participants (including the Commission Services)

RE = Restricted to a group specified by the consortium (including the Commission Services)

CO = Confidential, only for members of the consortium (including the Commission Services)

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SECTION A18

1. Executive Summary

This deliverable reports the actions taken by the SOFI consortium in terms of dissemination of the project results during the 3rd year of the project covering the period from January 2012 to July 2013 included.

In the third year of the SOFI project a significant amount of knowledge was generated in the specific topics related to the project.

While the actual exploitation activities and plans are detailed in Deliverable 6.9, it is worth mentioning the good results achieved during the third year suggest great potential for the further developments of the technologies and devices developed within SOFI after the conclusion of the project.

To disseminate the project results and promote its visibility several actions were taken by the different partners:

- The project web site was updated providing summary of the activities performed over the full duration of the project, including list of publications and participation to events like conferences and trade shows.
- Significant presence at the most relevant optical conferences and symposiums in 2012 and in first half of 2013.

All partners have been very active in promoting the SOFI project in renowned scientific journals, magazines, conferences and seminars with great impact.

2. Dissemination of Knowledge

All partners of the SOFI consortium have been committed to mobilize their contacts in the international research society and industry to promote the project results.

The participation in conferences, workshops and EU events not only falls in the project scope but it is one of the main project objectives.

Scientific contributions have and will continue to be submitted, throughout the project lifetime, for publication to journals/conferences, provided that they will enhance project visibility and release useful conclusions to the telecom community.

The dissemination plan includes the creation and maintenance of a professional project website containing all public information and facilitating contacts and exchanges with other research and industrial initiatives on the relevant topics. This consortium WEB site was created and is maintained by KIT with inputs from all partners.

In Sections 3.1 to 3.6 the activities per partner are listed.

3.1 RB Dissemination activities

Conferences and Symposiums

Rainbow Photonics was present at the following international exhibitions with the company booth, where we were also promoting our work within the SOFI project:

- SPIE Photonics West exhibition, Febr. 4–7 2013 in San Francisco USA
- Laser World of Photonics exhibition, May 13-16 2013 in Munich, Germany

In the reporting period Rainbow Photonics promoted the activities within SOFI in the following papers:

- **‘Organic DSTMS crystals for high-field wide bandwidth THz spectroscopy’** (Invited, Keynote Presentation); Peter Günter, Mojca Jazbinsek, Tobias Bach, Blanca Ruiz, Carolina Medrano, SPIE Photonics West (February 2-7, 2013); San Francisco, USA. This presentation promoted organic electro-optic crystals for generation and detection of THz waves, but also their potential for high-speed integrated optics.
- **‘Generation of frequency tunable and broadband THz pulses in the frequency range 1-20 THz with organic electro-optic crystals OH1 and DSTMS’** (Oral presentation); Mojca Jazbinsek, Tobias Bach, Blanca Ruiz, Carolina Medrano, Peter Günter; SPIE Photonics West (February 2-7, 2013), San Francisco, USA. Experimental results on frequency tunable THz-wave generation with bulk organic crystals, also mentioning their potential for high-speed integrated optics.
- **‘Broadband THz-Wave Generation with Organic Crystals OH1 and DSTMS’**; Mojca Jazbinsek, Blanca Ruiz, Carolina Medrano, Peter Günter; CLEO Europe (May 12-16, 2013), Munich, Germany. Experimental results on ultra-broadband THz-wave generation with bulk organic crystals based on their ultra-fast electro-optic response.
- SOFI partners presented an invited paper to ICTON 2012 (July 2 – 5, 2012, Coventry, UK), **‘Silicon organic hybrid fabrication platform for integrated circuits’**; Korn, D.; Alloatti, L.; Lauermann, M.; Pfeifle, J.; Palmer, R.; Schindler, P. C.; Freude, W.; Koos, C.; Leuthold, J.; Yu, H.; Bogaerts, W.; Komorowska, K.; Baets, R.; Van Campenhout, J.; Verheyen, P.; Wouters, J.; Moelants, M.; Absil, P.; Dispenza, M.; Secchi, A.; Jazbinsek, M.; Gunter, P.; Wehrli, S.; Bossard, M.; Zakyntinos, P.; Tomkos, I.;
- One journal paper by KIT, RB and IMEC on hybrid integration of organic crystals in silicon platform is in preparation.

3.2 AIT Dissemination activities

Conferences and Symposiums

- **AIT** presented a paper at Fifth International Conference on Micro - Nanoelectronics, Nanotechnologies and MEMS "Micro&Nano2012" (October 7-10, 2012, Heraklion, Greece). This work included the results from the simulation studies performed under WP2 on the potentials of the SOFI devices in high speed telecom systems. Paper title and author list: **"Silicon-Organic Hybrid Modulators for High Speed Transmission Systems"**, **Panagiotis Zakynthinos, Leontios Stampoulidis, Efstratios Kehayas and Ioannis Tomkos**
- **KIT** and **AIT** submitted a successful post-deadline paper to OFC 2013 conference (March 17-21, 2013, LA, USA) presenting the results obtained during the SOFI-GALACTICO experimental activity. Paper title and author list: **"Experimental Demonstration of up to 64-QAM Modulation Formats Using the First High-Speed Monolithic IQ GaAs Electro-optic Modulator"**, **D. Korn, P. C. Schindler, C. Stamatiadis, M. F. O'Keefe, L. Stampoulidis, R. Schmogrow, P. Zakynthinos, N. Cameron, Y. Zhou, R. G. Walker, E. Kehayas, I. Tomkos, L. Zimmermann, R. Palmer, W. Freude, C. Koos, J. Leuthold**
- **KIT, GO, IMEC** and **AIT** partners prepared and submitted an invited paper to OSA's Annual Meeting, Frontiers in Optics 2013 (October 6-10, 2013, Orlando, FL, USA.). Paper title and author list: **"Nonlinear Nano-Photonics"**, **W. Freude, L. Alloatti, M. Lauer mann1 A. Melikyan, D. Korn, R. Palmer, J. Pfeifle, P. C. Schindler, C. Weimann1 R. Dinu, J. Bolten, T. Wahlbrink, M. Waldow, S. Walheim, P. M. Leufke, S. Ulrich, J. Ye, P. Vincze, H. Hahn, H. Yu, W. Bogaerts, K. Hartinger, V. Brasch, T. Herr, R. Holzwarth, C. Stamatiadis, M. F. O'Keefe, L. Stampoulidis, L. Zimmermann, R. Baets, Th. Schimmel, I. Tomkos, K. Petermann, T. Kippenberg, C. Koos, J. Leuthold**
- SOFI partners submitted an invited paper to ICTON 2012 (July 2 – 5, 2012, Coventry, UK, presenting the project concept, technology and achievements. Paper title and author list: **"Silicon-organic hybrid fabrication platform for integrated circuits"**, **D. Korn, L. Alloatti, M. Lauer mann, J. Pfeifle, R. Palmer, P.C. Schindler, W. Freude, C. Koos, J. Leuthold, Hui Yu, W. Bogaerts, K. Komorowska, R. Baets, J. Van Campenhout, P. Verheyen, J. Wouters, M. Moelants, P. Absil, A. Secchi, M. Dispenza, S. Wehrli, M. Bossard, P. Zakynthinos, I. Tomkos**

Journals

- KIT and AIT partners submitted an invited paper to Journal of Lightwave Technology presenting the results obtained during the SOFI-GALACTICO collaboration experimental activities. Paper title and author list: **“Monolithic GaAs Electro-Optic IQ Modulator Demonstrated at 150 Gbit/s with 64QAM”**, P. C. Schindler, D. Korn, C. Stamatiadis, M.F. O’Keefe, L. Stampoulidis, R. Schmogrow, P. Zakynthinos, R. Palmer, N. Cameron, Y. Zhou, R. G. Walker, E. Kehayas, I. Tomkos, L. Zimmermann, K Petermann, W. Freude, C. Koos, and J. Leuthold.

Other Dissemination Activities

- During a short seminar event, AIT has presented the SOFI technology platform to interested AIT graduate students and researchers.
- AIT organised two conference workshops:
 - a) A Special Session on “Silicon Photonics Based Components”, co-located with ICTON 2012, held in Coventry, England, on July 2 – 5, 2012.
 - b) A joint Special Session in collaboration with ICT FP7-NAVOLCHI on "CMOS Fabrication-Based Photonic Technologies for Communications" co-located with ICTON 2013, held in Cartagena, Spain on June 23-27, 2013More details about these two events are provided in D6.7
- During the “Niki Award 2012” event, AIT’s researchers presented the SOFI project and its achievements to the director of Lawrence Berkeley National Laboratory and to a large number of scientists.
- AIT prepared an extended presentation for the Europhotonics Spring School 2013 (April 8-10, Pforzheim, Germany) organized by *KIT*. More details about this event is provided in D6.7

3.3 SELEX Dissemination activities

Conferences and Symposiums

In the reporting period Selex contributed to the following papers:

- SOFI partners presented an invited paper to ICTON 2012 (July 2 – 5, 2012, Coventry, UK), ‘**Silicon organic hybrid fabrication platform for integrated circuits**’; Korn, D.; Alloatti, L.; Lauermann, M.; Pfeifle, J.; Palmer, R.; Schindler, P. C.; Freude, W.; Koos, C.; Leuthold, J.; Yu, H.; Bogaerts, W.; Komorowska, K.; Baets, R.; Van Campenhout, J.; Verheyen, P.; Wouters, J.; Moelants, M.; Absil, P.; Dispenza, M.; Secchi, A.; Jazbinsek, M.; Gunter, P.; Wehrli, S.; Bossard, M.; Zakyntinos, P.; Tomkos, I;
- SOFI partners contributed to a joint Special Session in collaboration with ICT FP7-NAVOLCHI on "CMOS Fabrication-Based Photonic Technologies for Communications" co-located with ICTON 2013, held in Cartagena, Spain on June 23-27, 2013

3.4 GO Dissemination activities

Conferences and Symposiums

GigOptix was present at the following international exhibitions with the company booth, where we were also promoting our work within the SOFI project:

- ECOC 2012, September 16–20 2012 in Amsterdam, The Netherlands
- OFC 2013, March 19-21 2013 in Anaheim, USA

In the reporting period GigOptix contributed to the following papers:

- **'Nonlinear Nano-Photonic'**, W. Freude, L. Alloatti, M. Lauerma¹ A. Melikyan, D. Korn, R. Palmer, J. Pfeifle, P. C. Schindler, C. Weimann¹ R. Dinu, J. Bolten, T. Wahlbrink, M. Waldow, S. Walheim, P. M. Leufke, S. Ulrich, J. Ye, P. Vincze, H. Hahn, H. Yu, W. Bogaerts, K. Hartinger, V. Brasch, T. Herr, R. Holzwarth, C. Stamatiadis, M. F. O'Keefe, L. Stampoulidis, L. Zimmermann, R. Baets, Th. Schimmel, I. Tomkos, K. Petermann, T. Kippenberg, C. Koos, J. Leuthold; Invited paper to OSA's Annual Meeting, *Frontiers in Optics 2013*, October 6-10, 2013, Orlando, FL, USA.
- **'Silicon-organic hybrid (SOH) IQ modulator for 16QAM at 112 Gbit/s'**; Korn, D.; Palmer, R.; Yu, H.; Schindler, P. C.; Alloatti, L.; Baier, M.; Schmogrow, R.; Bogaerts, W.; Selvaraja, S.; Lepage, G.; Pantouvaki, M.; Wouters, J.; Verheyen, P.; Van Campenhout, J.; Absil, P.; Baets, R.; Dinu, R.; Koos, C.; Freude, W.; Leuthold, J.; *Conference on Lasers and Electro-Optics Europe (CLEO-Europe/IQEC 2013)*, International Congress Centre Munich, Germany; Paper [CK-9. 2 THU](#); May 12–16, 2013;
- **'Silicon-Organic Hybrid (SOH) Modulator Generating up to 84 Gbit/s BPSK and M-ASK Signals'**; Palmer, R.; Alloatti, L.; Korn, D.; Schindler, P.C.; Schmogrow, R.; Baier, M.; Koenig, S.; Hillerkuss, D.; Bolten, J.; Wahlbrink, T.; Waldow, M.; Dinu, R.; Freude, W.; Koos, C. and Leuthold, J.; *Optical Fiber Communication Conference (OFC2013) Anaheim, CA; Novel Modulators (OW4J)*; pp. OW4J.6; March 17, 2013
- **'Silicon-organic hybrid devices'**; Alloatti, L.; Korn, D.; Pfeifle, J.; Palmer, R.; Koeber, S.; Baier, M.; Schmogrow, R.; Diebold, S.; Pahl, P.; Zwick, T.; Yu, H.; Bogaerts, W.; Baets, R.; Fournier, M.; Fedeli, J.; Dinu, R.; Koos, C.; Freude, W.; Leuthold, J.; *OPTO SPIE Photonics West (OPTO-SPIE'13)*, San Francisco (CA), USA, paper 8629-24; Feb. 2-7, 2013,[invited]
doi:10.117/12.2005866
- **'Silicon organic hybrid fabrication platform for integrated circuits'** Korn, D.; Alloatti, L.; Lauerma¹, M.; Pfeifle, J.; Palmer, R.; Schindler, P. C.; Freude, W.; Koos, C.; Leuthold, J.; Yu, H.; Bogaerts, W.; Komorowska, K.; Baets, R.; Van

Campenhout, J.; Verheyen, P.; Wouters, J.; Moelants, M.; Absil, P.; Dispenza, M.; Secchi, A.; Jazbinsek, M.; Gunter, P.; Wehrli, S.; Bossard, M.; Zakyntinos, P.; Tomkos, I.;
14th Intern. Conf. on Transparent Optical Networks (ICTON'12), University of Warwick, Coventry, UK, July 2012 [**SOFI, invited**]

Journals

In the reporting period GigOptix contributed to the following journals publications:

- **'Silicon-organic hybrid (SOH) IQ modulator using the linear electro-optic effect for transmitting 16QAM at 112 Gbit/s'**, D. Korn, R. Palmer, H. Yu, P. Schindler, L. Alloatti, M. Baier, R. Schmogrow, W. Bogaerts, S. Selvaraja, G. Lepage, M. Pantouvaki, J. Wouters, P. Verheyen, J. Van Campenhout, B. Chen, R. Baets, P. Absil, R. Dinu, C. Koos, W. Freude, and J. Leuthold, *Opt. Express* 21, 13219-13227 (2013).doi: 10.1364/OE.21.013219
- **'Low Power Mach-Zehnder Modulator in Silicon-Organic Hybrid Technology'**, Palmer, R.; Alloatti, L.; Korn, D.; Schindler, P.; Baier, M.; Bolten, J.; Wahlbrink, T.; Waldow, M.; Dinu, R.; Freude, W.; Koos, C.; Leuthold, J.; *IEEE Photonic Technol. Lett.*; Vol. 25?, Issue 99, pp. xx-yy, April 2013, doi: 10.1109/LPT. 2013.2260858
- **'Silicon-Organic Hybrid MZI Modulator Generating OOK, BPSK and 8-ASK Signals for up to 84 Gbit/s'**; Palmer, R.; Alloatti, L.; Korn, D.; Schindler, P. C.; Schmogrow, R.; Heni, W.; Koenig, S.; Bolten, J.; Wahlbrink, T.; Waldow, M.; Yu, H.; Bogaerts, W.; Verheyen, P.; Lepage, G.; Pantouvaki, M.; Van Campenhout, J.; Absil, P.; Dinu, R.; Freude, W.; Koos, C.; Leuthold, J.; *IEEE Photonics J.*; Vol. 5; Issue 2; pp. 6600907; 2013; doi: 10.1109/JPHOT.2013.2258142

3.5 IMEC Dissemination activities

Conferences and Symposiums

- L. Alloati, D. Korn, J. Pfeifle, R. Palmer, S. Koeber, M. Baier, R. Schmogrow, S. Diebold, P. Dahl, T. Zwick, H. Yu, W. Bogaerts, R. Baets, M. Fournier, J.-M. Fedeli, R. Dinu, C. Koos, W. Freude, J. Leuthold, **Silicon-Organic Hybrid Devices**,(invited) publication in Proc. SPIE, United States, (to be published).
- L. Alloati, D. Korn, D. Hillerkuss, T. Valliat, J. Li, R. Bonk, R. Palmer, T. Schellinger, A. Barklund, R. Dinu, J. Wieland, M. Fournier, J.-M. Fedeli, P. Dumon, R. Baets, C. Koos, W. Freude, J. Leuthold, **40 Gbit/s Silicon-Organic Hybrid (SOH) Phase Modulator**,accepted for publication in European Conference on Optical Communications 2010 (ECOC), Italy, (to be published).
- J. M. Brosi, C. Koos, L. C. Andreani, P. Dumon, R. Baets, J. Leuthold, W. Freude, **100 Gbit/s / 1 V Optical Modulator with Slotted Slow-Light Polymer-Infiltrated Silicon Photonic Crystal**,accepted for publication in 2008 Slow and Fast Light Topical Meeting, United States, (to be published) .
- D. Korn, H. Yu, D. Hillerkuss, L. Alloati, C. Mattern, K. Komorowska, W. Bogaerts, R. Baets, J. Van Campenhout, P. Verheyen, J. Wouters, M. Moelants, P. Absil, C. Koos, W. Freude, J. Leuthold, **Detection or Modulation at 35 Gbit/s with a standard CMOS-processed optical waveguide**,the Conference on Lasers and Electro-Optics 2012, p.CTu1A.1 (2012) .
- Melikyan, M. Sommer, A. Muslija, M. Kohl, S. Muehlbrandt, A. Mishra, V. Calzadilla, Y. Justo, J.P. Martinez-Pastor, I. Tomkos, A. Scandurra, D. Van Thourhout, Z. Hens, M. Smit, W. Freude, C. Koos, J. Leuthold, **Chip-to-chip plasmonic interconnects and the activities of EU project NAVOLCHI**,14th International Conference on Transparent Optical Networks (ICTON 2012) (invited), United Kingdom, p.paper Th.A5.1 (2012) .
- D. Korn, L. Alloati, M. Lauermann, J. Pfeifle, R. Palmer, P.C. Schindler, W. Freude, C. Koos, J. Leuthold, H. Yu, W. Bogaerts, K. Komorowska, R. Baets, J. Van Campenhout, P. Verheyen, J. Wouters, M. Moelants, P. Absil, A. Secchi, M. Dispenza, M. Jazbinsek, P. Gunter, S. Wehrli, M. Bossard, P. Zakynthinos, I. Tomkos, **Silicon-Organic Hybrid Fabrication Platform for Integrated Circuits**,ICTON 2012 (invited), United Kingdom, p.paper Th.A5.5 (2012) .
- H. Yu, M. Pantouvaki, J. Van Campenhout, K. Komorowska, P. Dumon, P. Verheyen, G. Lepage, P. Absil, D. Korn, D. Hillerkuss, J. Leuthold, R. Baets, W. Bogaerts, **Silicon carrier-depletion-based mach-zehnder and ring modulators with different doping patterns for telecommunication and optical interconnect**,14th International Conference on Transparent Optical Networks (ICTON 2012) (invited), United Kingdom, p.paper Th.A4.3 (2012) .
- H. Yu, W. Bogaerts, K. Komorowska, R. Baets, Korn dietmar, Alloati Luca, Hillerkuss David, Koos Christian, Freude Wolfgang, Leuthold Juerg, Van Campenhout Joris, Verheyen Peter, Wouters Johan, Moelants Myriam, Absil Philippe, **Doping Geometries for 40G Carrier-Depletion-Based Silicon Optical Modulators**,The Optical Fiber Communication Conference and Exposition (OFC) and The National Fiber Optic Engineers Conference (NFOEC) 2012, United States, p. OW4F.4 (2012) .
- W. Freude, L. Alloati, A. Melikyan, R. Palmer, D. Korn, N. Lindenmann, T. Vallaitis, D. Hillerkuss, J. Li, A. Barkund, R. Dinu, J. Wieland, M. Fournier, J. Fedeli, S. Walheim, P.M. Leufke, S. Ulrich, J. Ye, P. Vincze, H. Hahn, H. Yu, W. Bogaerts, P. Dumon, R. Baets, B. Breiten, F. Diederich, M.T. Beels, I. Biaggio, Th. Schimmel, C. Koos, J. Leuthold, **Nonlinear optics on the silicon platform**,The Optical Fiber Communication Conference and Exposition (OFC) and The National Fiber Optic Engineers Conference (NFOEC) 2012, United States, p.paper OTh3H.6 (2012) .
- Koos, L. Alloati, D. Korn, R. Palmer, D. Hillerkuss, J. Li, A. Barklund, R. Dinu, J. Wieland, M. Fournier, J.-M. Fedeli, H. Yu, W. Bogaerts, P. Dumon, R. Baets, W. Freude, J. Leuthold, **Silicon-**

Organic Hybrid (SOH) Electro-Optical Devices, Integrated Photonics Research, Silicon and Nano-Photonics (IPR) (invited), Canada, p.IWFI (2011) .

- Koos, L. Alloati, D. Korn, R. Palmer, T. Vallaitis, R. Bonk, D. Hillerkuss, J. Li, W. Bogaerts, P. Dumon, R. Baets, M.L. Scimeca, I. Biaggio, A. Bjarklund, R. Dinu, J. Wieland, M. Fournier, J.M. Fedeli, W. Freude, J. Leuthold, **Silicon nanophotonics and silicon-organic hybrid (SOH) integration**, General Assembly and Scientific Symposium, 2011 XXXth URSI , Turkey, (2010).
- W. Freude, L. Alloatti, T. Vallaitis, D. Korn, D. Hillerkuss, R. Bonk, R. Palmer, J. Li, T. Schellinger, M. Fournier, J. Fedeli, W. Bogaerts, P. Dumon, R. Baets, A. Barklund, R. Dinu, J. Wieland, M.L. Scimeca, I. Biaggio, B. Breiten, F. Diederich, C. Koos, J. Leuthold, **High-speed signal processing with silicon-organic hybrid devices**, EOS Annual Meeting 2010 (EOSAM 2010) (invited), France, p.paper 3601 (2010) .
- L. Alloatti, D. Korn, D. Hillerkuss, T. Vallaitis, J. Li, R. Bonk, R. Palmer, T. Schellinger, A. Barklund, R. Dinu, J. Wieland, M. Fournier, J. Fedeli, P. Dumon, R. Baets, C. Koos, W. Freude, J. Leuthold, **40 Gbit/s silicon-organic hybrid (SOH) phase modulator**, 36th European Conference and exhibition on Optical Communication, Italy, p.paper Tu.5.C.4 (2010) .
- L. Allioti , D. Korn, D. Hillerkuss , T. Vallaitis , J. Li, R. Bonk , R. Palmer , T. Schellinger , C. Koos , W. Freude, J. Leuthold , A. Barklund , R. Dinu , J. Wieland , J. Fournier , J. Fedeli, W. Bogaerts, P. Dumon, R. Baets, **Silicon high-speed electro-optic modulator**, 7th IEEE International Conference on Group IV Photonics, China, p.195-197 (ThC2) (2010) .
- J. Leuthold, C. Koos, W. Freude, T. Vallaitis, L. Alloatti, D. Korn, P. Dumon, W. Bogaerts, R. Baets, I. Biaggio, F. Diederich, **Signal processing with silicon-organic hybrid waveguides**, Integrated Photonics Research, Silicon and Nano Photonics (IPR), Photonics in Switching (PS), United States, p.IWC1.pdf (3 pages) (2010) .
- W. Freude, J. Leuthold, L. Aolloatti, T. Vallaitis, P. Dumon, R. Baets, B. Breiten, F. Diederich, J.-M. Brosi, M.L. Scimeca, I. Biaggio, A. Barklund, R. Dinu, J. Wieland, **100 Gbit/s electro-optic modulator and 56 Gbits/s wavelength converter for DQPSK data in silicon-organic hybrid (SOH) technology**, 2010 IEEE Photonics Society Summer Topicals (invited), Mexico, p.96-97 (2010) .

Journals

IMEC's journal publication with relation to SOFI are mainly joint publication with KIT.

- R. Palmer, L. Alloati, D. Korn, P.C. Schindler, R. Schmogrow, W. Heni, S. Koenig, J. Bolten, T. Wahlbrink, M. Waldow, H. Yu, W. Bogaerts, P. Verheyen, G. Lepage, M. Pantouvaki, J. Van Campenhout, P. Absil, R. Dinu, W. Freude, C. Koos, J. Leuthold, **Silicon-Organic Hybrid MZI Modulator Generating OOK, BPSK and 8-ASK Signals for up to 84 Gbit/s**, Photonics Journal, 5(2), p.6600907 (2013) .
- H. Yu, D. Korn, M. Pautouvaki, J. Van Campenhout, K. Komorowska, P. Verheyen, G. Lepage, P. Absil, D. Hillerkuss, J. Leuthold, R. Baets, W. Bogaerts, **Using carrier-depletion silicon modulators for optical power monitoring** , Optics letters, (2012) .
- H. Yu, M. Pantouvaki, J. Van Campenhout, D. Korn, K. Komorowska, P. Dumon, Y. Li, P. Verheyen, P. Absil, L. Alloatti, D. Hillerkuss, J. Leuthold, R. Baets , W. Bogaerts, **Performance tradeoff between lateral and interdigitated doping patterns for high speed carrier-depletion based silicon modulators**, Optics express, 20(12), p.12926-12938 (2012) .
- L. Alloatti, D. Korn, R. Palmer, D. Hillerkuss, J. Li, A. Barklund, R. Dinu, J. Wieland, R. Fournier, J.-M. Fedeli, H. Yu, W. Bogaerts, P. Dumon, R. Baets, C. Koos, W. Freude, J.

Leuthold, **42.7 Gbit/s electro-optic modulator in silicon technology**, Optics Express, 19(12), p.11841-11851 (2011) .

- J. Leuthold, C. Koos, W. Freude, L. Alloati, R. Palmer, D. Korn, J. Pfeifle, M. Lauer mann, R. Dinu, S. Wehrli, M. Jazbinsek, P. Gunter, M. Waldow, T. Wahlbrink, J. Bolten, J.-M. Fedeli, H. Yu, W. Bogaerts, **Silicon-Organic Hybrid Electro-Optical Devices**, (invited) publication in J. Sel. Quantum Electron, (submitted).
- D. Korn, R. Palmer, H. Yu, P.C. Schindler, L. Alloati, M. Baier, R. Schmorow, W. Bogaerts, S. Selvaraja, G. Lepage, M. Pantouvaki, J.M.D. Wouters, P. Verheyen, J. Van Campenhout, B. Chen, R. Baets, P. Absil, R. Dinu, C. Koos, W. Freude, J. Leuthold, **112 Gbit/s silicon-organic hybrid (SOH) IQ modulator using the linear electro-optic effect**, submitted for publication in Optics Express, (submitted).

Other Dissemination Activities

IMEC Organized a workshop on *Hybrid Silicon Photonics* at the European Conference on Optical Communication (ECOC) in Amsterdam, September 2012. The half-day workshop was attended by over 50 people and had several high-profile international speakers

- John Bowers, UCSB
- Juerg Leuthold, KIT,
- Lionel Kimerling, MIT
- John Kouvetakis, ASU
- Nicolas Izard, UP-Sud
- Peter Verheyen, IMEC

The focus of the workshop was on the integration of novel photonic materials in the CMOS-like environment of silicon photonics, and the benefits that this integration can bring. The SOFI project was organizer of this project, and the results of the project were prominently present in the presentation by Prof. Leuthold.

3.6 KIT Dissemination activities

Conferences and Symposiums

‘Silicon-Organic Hybrid (SOH) Frequency Comb Source for Data Transmission at 784 Gbit/s’

C. Weimann et al.; *ECOC 2013*

‘High-Speed Silicon-Organic Hybrid (SOH) Modulator with 1.6 fJ/bit and 180 pm/V In-Device Nonlinearity’

Palmer et al.; *ECOC 2013*

‘Silicon-organic hybrid (SOH) IQ modulator for 16QAM at 112 Gbit/s’;

Korn, D.; Palmer, R.; Yu, H.; Schindler, P. C.; Alloatti, L.; Baier, M.; Schmogrow, R.; Bogaerts, W.; Selvaraja, S.; Lepage, G.; Pantouvaki, M.; Wouters, J.; Verheyen, P.; Van Campenhout, J.; Absil, P.; Baets, R.; Dinu, R.; Koos, C.; Freude, W.; Leuthold, J.; *Conference on Lasers and Electro-Optics Europe (CLEO-Europe/IQEC 2013)*, International Congress Centre Munich, Germany; Paper [CK-9. 2 THU](#); May 12–16, 2013;

‘Surface Plasmon Polariton High-Speed Modulator’

A. Melikyan et al; **Postdeadline Paper** CLEO 2013

‘First monolithic GaAs IQ electro-optic modulator, demonstrated at 150 Gbit/s with 64-QAM,’

Korn, D.; Schindler, P. C.; Stamatiadis, C.; O’Keefe, M. F.; Stampoulidis, L.; Schmogrow, R.; Zakynthinos, P.; Palmer, R.; Cameron, N.; Zhou, Y.; Walker, R. G.; Kehayas, E.; Tomkos, I.; Zimmermann, L.; Petermann, K.; Freude, W.; Koos, C.; Leuthold, J.; *Optical Fiber Communication Conference (OFC’13)*, Los Angeles, Anaheim (CA), USA, 17.–21.03.2013

Postdeadline Paper PDP5C.4

‘Silicon-Organic Hybrid (SOH) Modulator Generating up to 84 Gbit/s BPSK and M-ASK Signals’;

Palmer, R.; Alloatti, L.; Korn, D.; Schindler, P.C.; Schmogrow, R.; Baier, M.; Koenig, S.; Hillerkuss, D.; Bolten, J.; Wahlbrink, T.; Waldow, M.; Dinu, R.; Freude, W.; Koos, C. and Leuthold, J.;

Optical Fiber Communication Conference (OFC2013) Anaheim, CA; Novel Modulators (OW4J); pp. OW4J.6; March 17, 2013

‘Silicon-organic hybrid devices’

Alloatti, L.; Korn, D.; Pfeifle, J.; Palmer, R.; Koeber, S.; Baier, M.; Schmogrow, R.; Diebold, S.; Pahl, P.; Zwick, T.; Yu, H.; Bogaerts, W.; Baets, R.; Fournier, M.; Fedeli, J.; Dinu, R.; Koos, C.; Freude, W.; Leuthold, J.;

OPTO SPIE Photonics West (OPTO-SPIE’13), San Francisco (CA), USA, paper 8629-24; Feb. 2-7, 2013,[invited]

doi:10.117/12.2005866

'Ultracompact CMOS-compatible Modulators' [↗](#);

Leuthold, J.; Melikyan, A.; Korn, D.; Alloatti, L.; Palmer, R.; Koos, C.; Freude, W.; Proc. Frontiers in Optics Conference, OSA, Rochester, NY, paper FTu4A.1, Oct. 2012
<http://www.opticsinfobase.org/abstract.cfm?URI=FiO-2012-FTu4A.1> [↗](#)

'Silicon-Organic Hybrid - a path towards active silicon photonic devices' ;

Leuthold, J.; Koos, C.; Freude, W.; Alloatti, L.; Palmer, R.; Korn, D.; Pfeifle, L.; Lauermann, L.; Proc. EOS Annual Meeting (EOSAM 2012), paper 6441, Sept. 2012

'Silicon-Organic Hybrid Integration and Photonic Wire Bonding: Technologies for Terabit/s Interconnects' ;

Koos., C.; Leuthold, J.; Freude, W.; Alloatti, L.; Korn, D.; Palmer, R.; Lauermann, M.; Lindenmann, N.; Koeber, S.; Pfeifle, J.; Schindler, P.C; Hillerkuss, D.; Schmogrow, R.; Joint Symposium on Opto- and Microelectronic Devices and Circuits (SODC2012), Hangzhou, China, Sept. 24-27, 2012 [invited]

'Ultracompact CMOS-compatible Modulators'

Leuthold, J.; Melikyan, A.; Korn, D.; Alloatti, L.; Palmer, R.; Koos, C.; Freude, W.; Proc. Frontiers in Optics Conference, OSA, Rochester, NY, paper FTu4A.1, Oct. 2012
<http://www.opticsinfobase.org/abstract.cfm?URI=FiO-2012-FTu4A.1>

'Silicon organic hybrid fabrication platform for integrated circuits'

Korn, D.; Alloatti, L.; Lauermann, M.; Pfeifle, J.; Palmer, R.; Schindler, P. C.; Freude, W.; Koos, C.; Leuthold, J.; Yu, H.; Bogaerts, W.; Komorowska, K.; Baets, R.; Van Campenhout, J.; Verheyen, P.; Wouters, J.; Moelants, M.; Absil, P.; Dispenza, M.; Secchi, A.; Jazbinsek, M.; Gunter, P.; Wehrli, S.; Bossard, M.; Zakynthinos, P.; Tomkos, I.; 14th Intern. Conf. on Transparent Optical Networks (ICTON'12), University of Warwick, Coventry, UK, July 2012 [SOFI, invited]

Journals**'Silicon-Organic Hybrid Electro-Optical Devices'**

Leuthold et al., *JSTQE* 2013

'High-Speed Plasmonic Phase Modulator'

A. Melikyan et al., *submitted to Nature Photonics* 2013

'Silicon-organic hybrid (SOH) IQ modulator using the linear electro-optic effect for transmitting 16QAM at 112 Gbit/s'

D. Korn, R. Palmer, H. Yu, P. Schindler, L. Alloatti, M. Baier, R. Schmogrow, W. Bogaerts, S. Selvaraja, G. Lepage, M. Pantouvaki, J. Wouters, P. Verheyen, J. Van Campenhout, B. Chen, R. Baets, P. Absil, R. Dinu, C. Koos, W. Freude, and J. Leuthold,
Opt. Express 21, 13219-13227 (2013).doi: 10.1364/OE.21.013219

'Low Power Mach-Zehnder Modulator in Silicon-Organic Hybrid Technology'

Palmer, R.; Alloatti, L.; Korn, D.; Schindler, P.; Baier, M.; Bolten, J.; Wahlbrink, T.; Waldow, M.; Dinu, R.; Freude, W.; Koos, C.; Leuthold, J.;

IEEE Photonic Technol. Lett.; Vol. 25?, Issue 99, pp. xx-yy, April 2013
doi: 10.1109/LPT. 2013.2260858

'Silicon-Organic Hybrid MZI Modulator Generating OOK, BPSK and 8-ASK Signals for up to 84 Gbit/s' ;

Palmer, R.; Alloatti, L.; Korn, D.; Schindler, P. C.; Schmogrow, R.; Heni, W.; Koenig, S.; Bolten, J.; Wahlbrink, T.; Waldow, M.; Yu, H.; Bogaerts, W.; Verheyen, P.; Lepage, G.; Pantouvaki, M.; Van Campenhout, J.; Absil, P.; Dinu, R.; Freude, W.; Koos, C.; Leuthold, J.; IEEE Photonics J.; Vol. 5; Issue 2; pp. 6600907; 2013
doi: 10.1109/JPHOT.2013.2258142

'Low-Loss Silicon Strip-to-Slot Mode Converters.'

Palmer, R.; Alloatti, L.; Korn, D.; Heni, W.; Schindler, P. C.; Bolten, J.; Karl, M.; Waldow, M.; Wahlbrink, T.; Freude, W.; Koos, C.; Leuthold, J.; February 2013
IEEE Photonics J.; Vol. 5; issue 1; pp. 2200409
doi: [10.1109/JPHOT.2013.2239283](https://doi.org/10.1109/JPHOT.2013.2239283)

'Using carrier-depletion silicon modulators for optical power monitoring' 

Yu, H.; Korn, D.; Pantouvaki, M.; V. Campenhout, J.; Komorowska, K.; Verheyen, P.; Lepage, G.; Absil, P.; Hillerkuss, D.; Alloatti, L.; Leuthold, J.; Baets, R.; Bogaerts, W.; Optics Letters, Vol.37, Issue 22, pp. 4681-4683, Sept., 2012

'Second-order nonlinear silicon-organic hybrid waveguide' ;

Alloatti, L.; Korn, D.; Weimann, C; Koos, C.; Freude, W.; Leuthold, J.; Optics Express, Vol. 20, Issue 18, pp. 20506-20515, Aug. 27, 2012
<http://dx.doi.org/10.1364/OE.20.020506>

'Silicon-organic hybrid phase shifter based on a slot waveguide with a liquid-crystal cladding'

Pfeifle, J.; Alloatti, L.; Freude, W.; Leuthold, J. and Koos, Ch.; Optics Express, Vol. 20, Issue 14, pp. 15359-15376, July 2012
<http://dx.doi.org/10.1364/OE.20.015359>

'Performance tradeoff between lateral and interdigitated doping patterns for high speed carrier-depletion based silicon modulators'

Yu, H.; Pantouvaki, M.; Van Campenhout, J.; Korn, D.; Komorowska, K.; Dumon, P.; Li, Y.; Verheyen, P.; Absil, P.; Alloatti, L.; Hillerkuss, D.; Leuthold, J.; Baets, R. and Bogaerts, W.; Optics Express, Vol. 20, Issue 12, pp. 12926-12938, June 2012
[dx.doi.org/10.1364/OE.20.012926](https://doi.org/10.1364/OE.20.012926)

3.6 Consortium Future Actions

The following 2 publications have been accepted for the ECOC 2013:

- **‘Silicon-Organic Hybrid (SOH) Frequency Comb Source for Data Transmission at 784 Gbit/s’**
C. Weimann et al.; *ECOC 2013*
- **‘High-Speed Silicon-Organic Hybrid (SOH) Modulator with 1.6 fJ/bit and 180 pm/V In-Device Nonlinearity’**
Palmer et al.; *ECOC 2013*

Activities on SOH are planned to continue at SOFI consortium members. Further experiments on 784 Gbit/s WDM-SOH comb line are currently under discussions and will likely focus on OFDM with SOFI3 chips.

Section A

TEMPLATE A1: LIST OF SCIENTIFIC (PEER REVIEWED) PUBLICATIONS, STARTING WITH THE MOST IMPORTANT ONES

NO	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Year of publication	Relevant pages	Permanent identifiers ^[1] (if available)	Is/Will open access ^[2] provided to this publication ?
1	'Silicon-organic hybrid (SOH) IQ modulator using the linear electro-optic effect for transmitting 16QAM at 112 Gbit/s'	KIT	Optics Express				2013		doi: 10.1364/OE.21.013219	yes
2	Low Power Mach-Zehnder Modulator in Silicon-Organic Hybrid Technology	KIT	IEEE Photonic Technol. Lett.;				2013		doi: 10.1109/LPT. 2013.2260858	
3	'Silicon-Organic Hybrid MZI Modulator Generating OOK, BPSK and 8-ASK Signals for up to 84 Gbit/s'	KIT	IEEE Photonics J.				2013		doi: 10.1109/JPHOT.2013.2258142	
4	'Low-Loss Silicon Strip-to-Slot Mode Converters,'	KIT	IEEE Photonics J.				2013		doi: 10.1109/JPHOT.2013.2239283	
5	'Second-order nonlinear silicon-organic hybrid waveguide	KIT	Optics Express				2012		dx.doi.org/10.1364/OE.20.020506	yes
6	Silicon-organic hybrid	KIT	Optics Express				2012		dx.doi.org/10.1364/OE.20.01535	yes

^[1] A permanent identifier should be a persistent link to the published version full text if open access or abstract if article is pay per view) or to the final manuscript accepted for publication (link to article in repository).

^[2] Open Access is defined as free of charge access for anyone via Internet. Please answer "yes" if the open access to the publication is already established and also if the embargo period for open access is not yet over but you intend to establish open access afterwards.

FP7-ICT-2009.3.8

Date of preparation:

Version:

SOFI –Deliverable 6.8

Project-No. 248609

16/7/2013

1.0 submission

	phase shifter based on a slot waveguide with a liquid-crystal cladding								9	
7	42.7 Gbit/s electro-optic modulator in silicon technology	<i>KIT</i>	Optics Express				2011		doi:10.1364/OE.19.011841	yes
8	Monolithic GaAs Electro-Optic IQ Modulator Demonstrated at 150 Gbit/s with 64 QAM	KIT	Lightwave Technology				2013			yes

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES								
NO.	Type of activities ^[3]	Main leader	Title	Date/ Period	Place	Type of audience ^[4]	Size of audience	Countries addressed
1	Conference	KIT	ECOC	2013	London, UK	scientific	>1000	international
2	Conference	KIT	CLEO Europe	2013	Munich, Germany	scientific	>1000	international
3	Conference	KIT	CLEO US	2013	San Jose, USA	scientific	>1000	international
4	Conference	KIT	OFC	2013	Los Angeles, USA	scientific	>1000	international
5	Conference	KIT	ECOC	2012	Europe	scientific	>1000	international
6	Conference	KIT	CLEO US	2012	San Jose, USA	scientific	>1000	international
7	Conference	KIT	OFC	2012	US	scientific	>1000	international
5	Conference	KIT	ECOC	2011	Europe	scientific	>1000	international
6	Conference	KIT	CLEO US	2011	Baltimore, USA	scientific	>1000	international
7	Conference	KIT	OFC	2011	USA	scientific	>1000	international
8	Exhibition	GO	ECOC	2012	Amsterdam, The Netherlands	Industry	>1000	international
9	Exhibition	GO	OFC	2013	Anaheim, USA	Industry	>1000	international
10	Exhibition	GO	ECOC	2011	Europe	Industry	>1000	international
11	Exhibition	GO	OFC	2012	USA	Industry	>1000	international
12	Exhibition	GO	ECOC	2010	Europe	Industry	>1000	international
13	Exhibition	GO	OFC	2011	USA	Industry	>1000	international
14	Exhibition	RB	SPIE Photonics West	2013	San. Francisco, USA	insustry	>1000	International

^[3] A drop down list allows choosing the dissemination activity: publications, conferences, workshops, web, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters, Other.

^[4] A drop down list allows choosing the type of public: Scientific Community (higher education, Research), Industry, Civil Society, Policy makers, Medias, Other ('multiple choices' is possible).

15	<i>Exhibition</i>	<i>RB</i>	<i>Laser World of Photonics</i>	<i>2013</i>	<i>Munich, Germany</i>	<i>Industry</i>	<i>>1000</i>	<i>International</i>
16	<i>Conference</i>	<i>KIT</i>	<i>Frontiers in Optics</i>	<i>2013</i>	<i>Orlando, FL, USA</i>	<i>Scientific</i>	<i>>1000</i>	<i>International</i>
17	<i>Workshop</i>	<i>AIT</i>	<i>ICTON</i>	<i>2013</i>	<i>Cartagena, Spain</i>	<i>Scientific</i>	<i>>1000</i>	<i>International</i>
18	<i>Spring School</i>	<i>AIT</i>	<i>Europhotonics</i>	<i>2013</i>	<i>Pforzheim, Germany</i>	<i>Scientific</i>	<i>>150</i>	<i>International</i>
19	<i>Conference</i>	<i>AIT</i>	<i>Micro&Nano</i>	<i>2012</i>	<i>Heraklion, Greece</i>	<i>Scientific</i>	<i>>300</i>	<i>International</i>
20	<i>Conference</i>	<i>KIT</i>	<i>ICTON</i>	<i>2012</i>	<i>Coventry, UK</i>	<i>Scientific</i>	<i>>1000</i>	<i>International</i>
21	<i>Workshop</i>	<i>AIT</i>	<i>ICTON</i>	<i>2012</i>	<i>Coventry, UK</i>	<i>Scientific</i>	<i>>1000</i>	<i>International</i>
22	<i>Conference</i>	<i>AIT</i>	<i>ICTON</i>	<i>2011</i>	<i>Stockholm, Sweden</i>	<i>Scientific</i>	<i>>1000</i>	<i>International</i>
23	<i>Conference</i>	<i>AIT</i>	<i>IEEE-ICT</i>	<i>2011</i>	<i>Cyprus</i>	<i>Scientific</i>	<i>>1000</i>	<i>International</i>
24	<i>Scientific Symposium</i>	<i>AIT</i>	<i>Niki Award2012</i>	<i>2012</i>	<i>Athens, Greece</i>	<i>Scientific</i>	<i>>100</i>	<i>International</i>
25	<i>Seminar</i>	<i>AIT</i>	<i>Internal presentation</i>	<i>2011</i>	<i>Athens, Greece</i>	<i>Scientific</i>	<i>>1000</i>	<i>National</i>