

1. Project information

Project acronym: CEREXPRO
Project full title: Ceramic heat exchangers with enhanced materials properties
Programme: Seventh framework programme,
ENERGY.2008.8.1.1: Energy efficiency of industrial heat exchangers and boilers
Grant agreement no.: 227551

Project logo:



List of beneficiaries:

<i>Beneficiary number</i>	<i>Beneficiary name</i>	<i>Beneficiary short name</i>	<i>Country</i>
1 (coordinator)	Technische Universität Bergakademie Freiberg	TU BAF	DE
2	Scuola Universitaria Professionale della Svizzera	SUPSI	CH
3	Politecnico di Torino	POLITO	IT
4	Institut Français du textile et de l'habillement	IFTH	FR
5	ERBICOL S.A.	ERBICOL	CH
6	WS Wärmeprozessstechnik GmbH	WS	DE
7	Aichelin Ges.m.b.H.	AICHELIN	AT
8	VFI VDMA-Gesellschaft für Forschung und Innovation mbH (representing the European Committee of Industrial Furnace and Heating Equipment Associations CECOF)	CECOF	DE

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2. Motivation

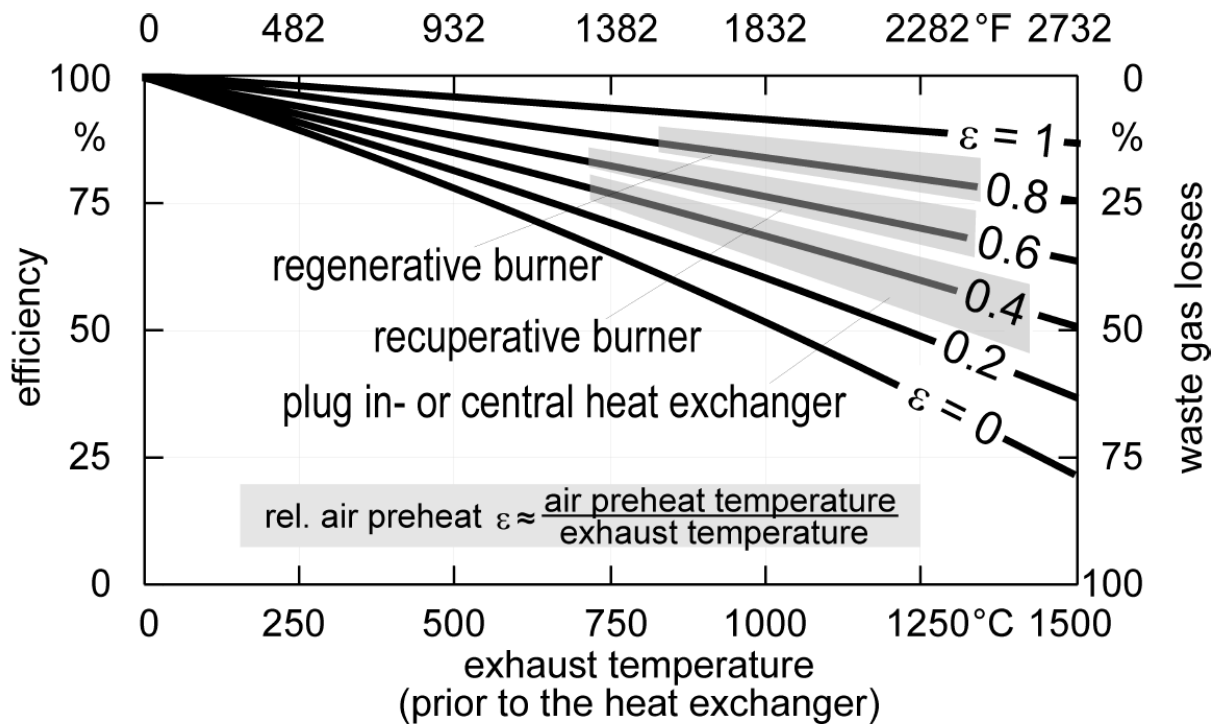


Figure 1: Combustion efficiency with respect to the flue gas temperature before heat recovery; Practical performance for different types of heat recovery [from Handbuch der Brennertechnik für Industrieöfen, Wünnig J. G., Milani A. (Eds.), Vulkan, Essen, 2007]



Figure 2: State of the art: typical burners of NOXMAT GmbH and WS GmbH with ceramic heat exchanging parts

3. WP 1000 - Basic heat exchanger design and optimization

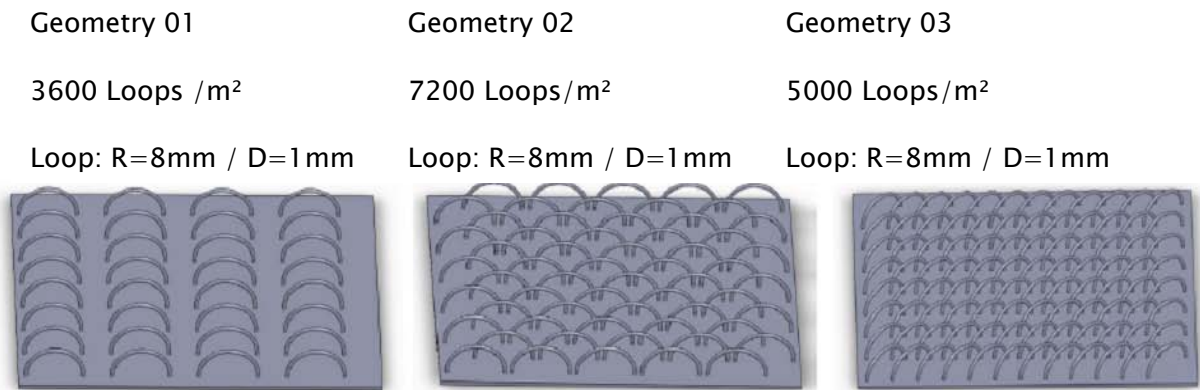


Figure 3: Different basic designs/arrangements of heat enhancing elements

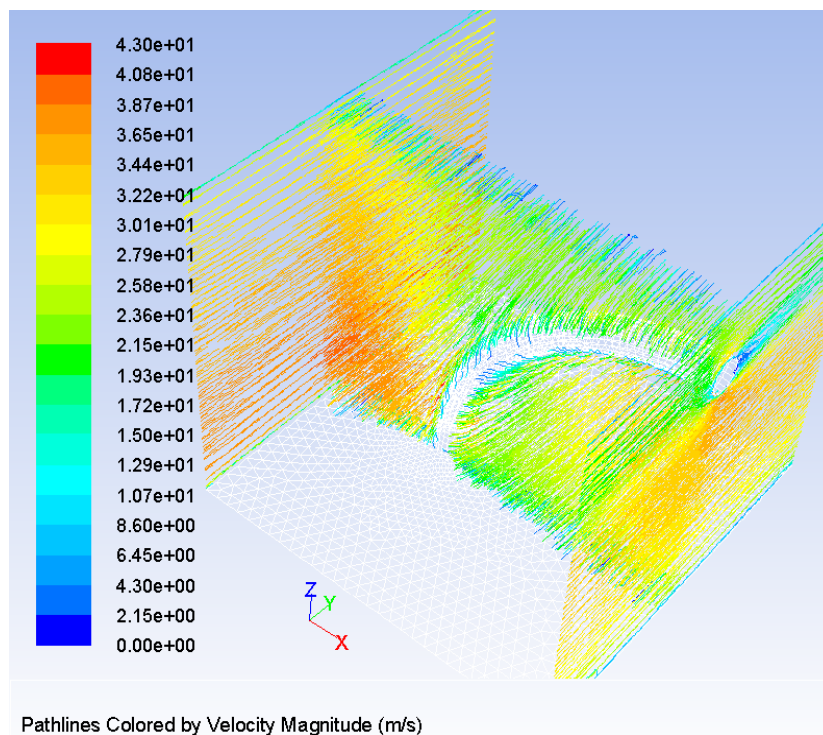


Figure 4: Result of a simulation with 3600 loops/m², here velocity field



Figure 5: Metal-loop structure for first validations test

4. WP2000 - Material and process development



Figure 6: Textile structures out of different material

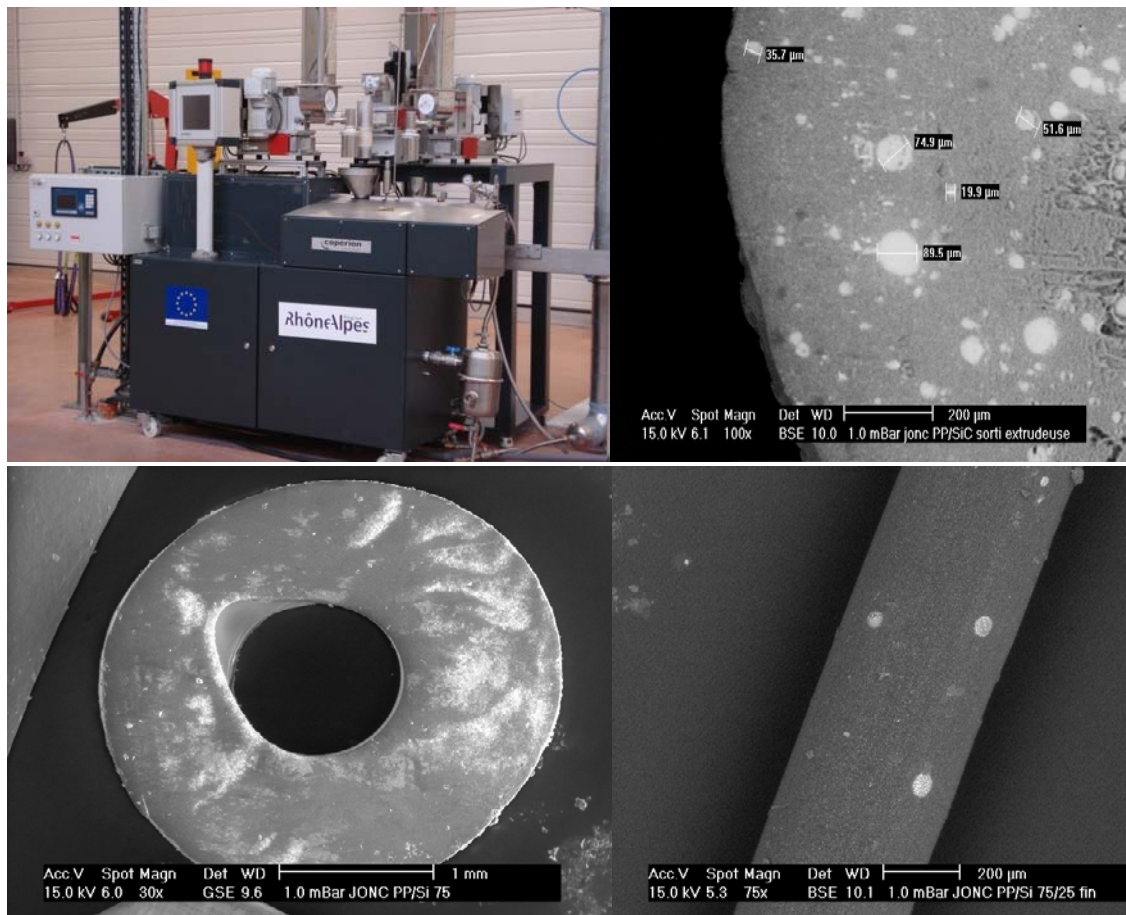
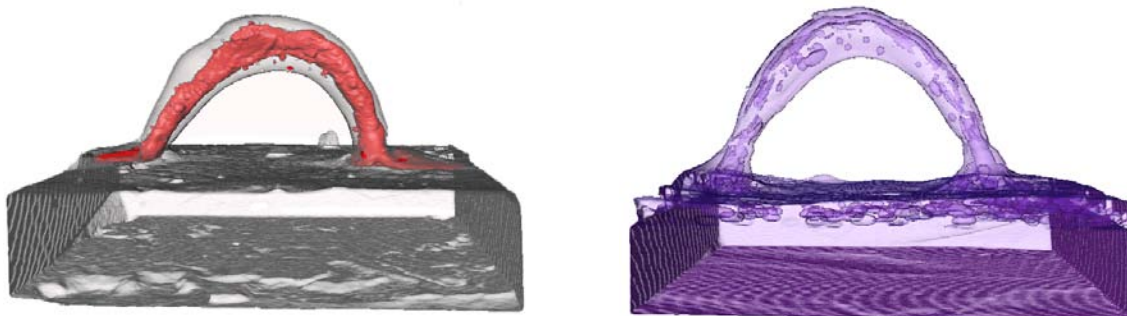


Figure 7: Polymer spinning of compounding trials of 75 % PP and 25 % SiC; Polymer spinning pilot and ESEM micrographics of the produced monofilaments



Fugitive fiber

Non fugitive fiber

Figure 8: Rendering of the loop structures

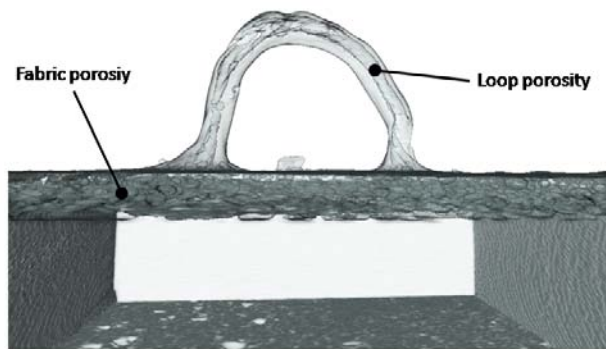


Figure 9: Voids inside the loops and on the plate due by the supporting fabric

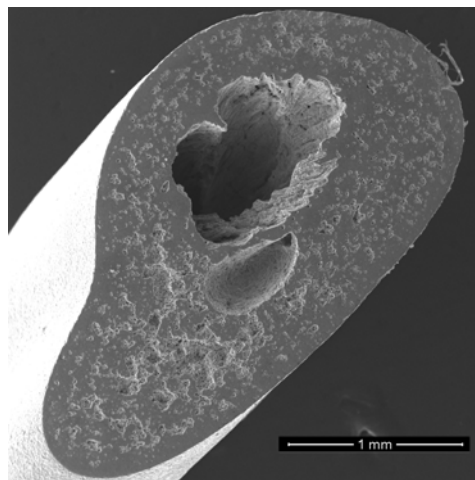


Figure 10: ESEM micrographic of a cut loop with fugitive fiber as template



Figure 11: Si infiltrated SiC structure with loops as heat enhancing elements

WP3000 - Heat exchanger development and application integration

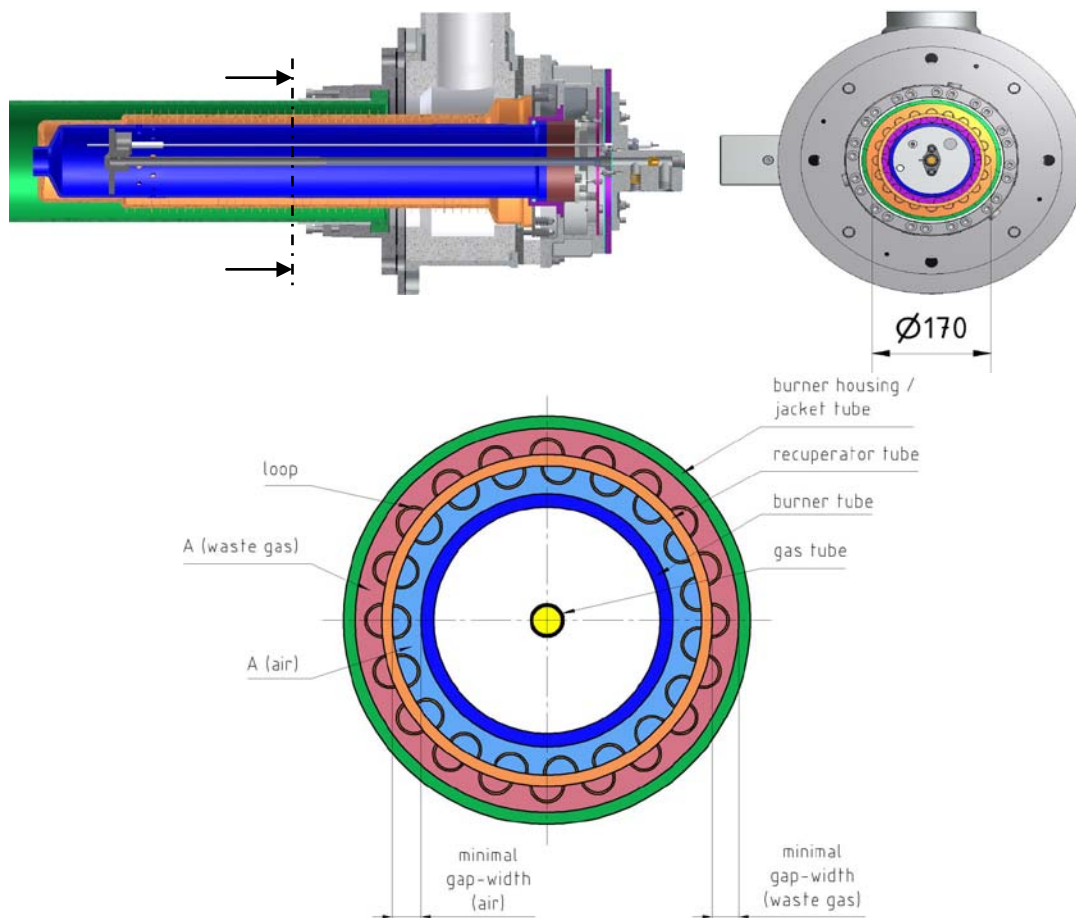


Figure 9: Burner Model with loops assembled in a jacket tube

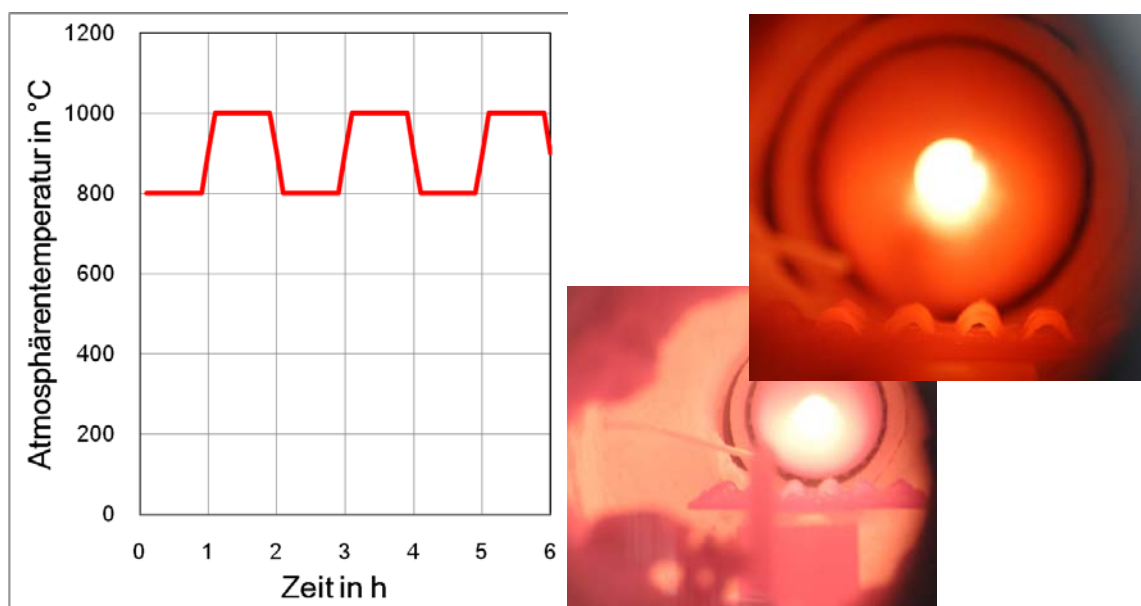


Figure 12: Material testing, delaminating test of first flat plat structures



Figure 13: Model of the unstructured recuperative element left and with loops structured recuperative element right

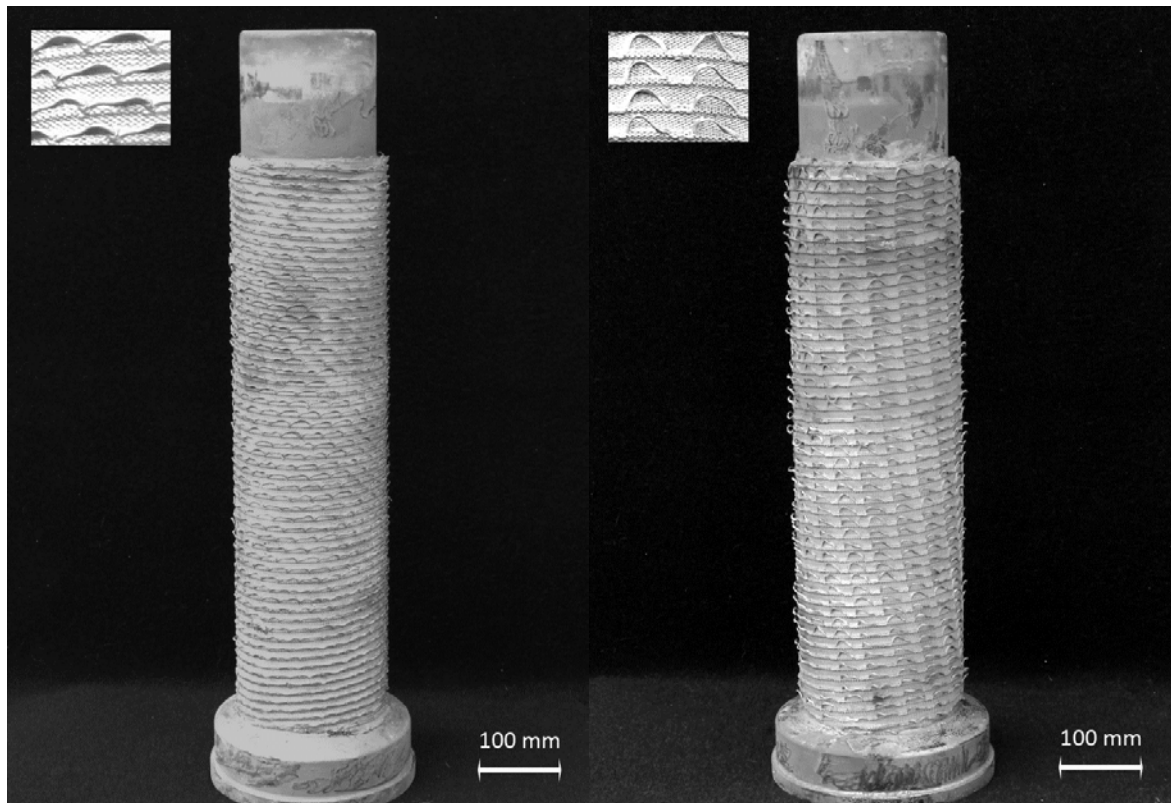


Figure 14: with loops structured recuperative element after ceramization, 2 different geometries

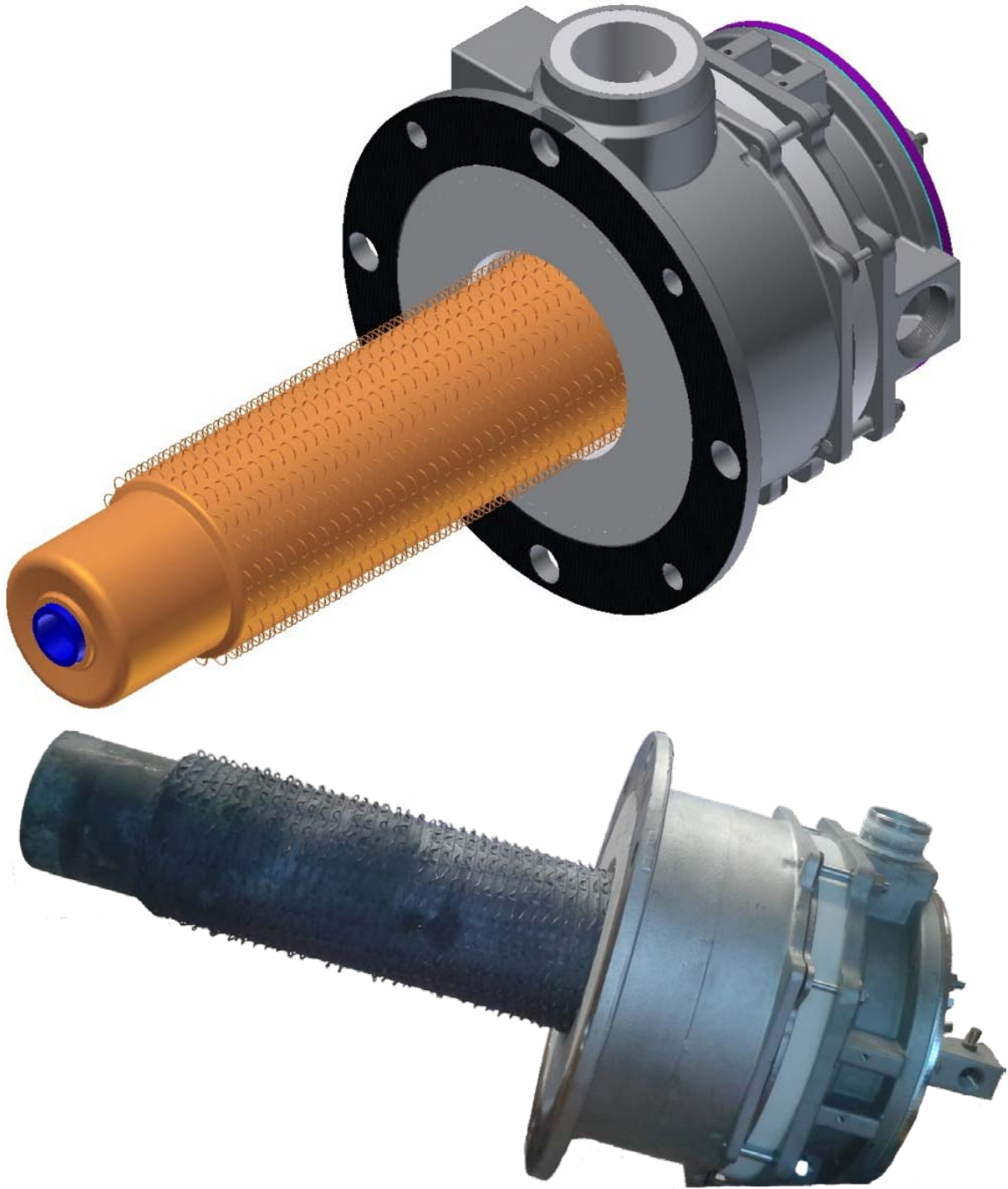


Figure 15: First prototype recuperative burner with loop structured heat exchanging surface, CAD-modell on top and realized burner prototype on bottom



Figure 16: Evolution of the manufacturing process during the project