The aim of this research was to develop an effective, selective synthesis way to make new quite modern synthetic polymeric materials with continuously more sophisticated, well-defined properties and structures. The general strategy was to prepare homo- and block copolymers containing a regular non-polar backbone (polyvinylcyclopentane) with chromophores (arene) and linear side-chain (aliphatic hydrocarbons with or without heteroatoms i.e. O, N and siloxanes). Three well-defined ruthenium catalysts of different activity were used as initiators of the metathesis polymerization of norbornenes bearing dissimilar length and type of side-chain G^1, G^2, G^3. Then, photo-physical and thermal properties of final pure products were examined.

- ✓ The major substrate, pure *exo*-norbornene-5,6-dicarboxyanhydride, which was used for next step of manufacturing new monomers was produced *via* Diels-Alder reaction with high final yield. This compound was easily available from commercial substrates by well-established synthetic route.
- ✓ At the beginning, the group of functional monomers which can rapidly undergo ROMP in the presence of Grubbs' ruthenium initiators was selected, prepared and tested.
- ✓ A very efficient, convenient catalytic system was found allowing to produce a large group of many various, new imides derivatives with very good yields and high purity of the final products. These include examples that have not been described in the literature yet. All of them were characterized by *exo*-conformation. That is why they have potential application in stereoselective and controlled polymerization process (patent in preparation).
- ✓ Several preliminary and advanced catalytic tests of the ring opening metathesis polymerization process were made in the presence of Grubbs' catalysts in mild conditions (room temperature, air exposure, very low concentration of catalyst, kind and amount of solvent) in typical glass-reactor connected to condenser. White or colourless solid, transparent film and very stable, soluble materials were obtained successfully.
- ✓ A very good, effective and useful 'polymerization system' was discovered and studied precisely. Aforesaid system allows to synthesise each NBD-polymer derivative with precise molecular weight and very narrow polidispersity index. These compounds are also investigated in current research in other various combinations of monomers for block and cross-linked materials.
- ✓ The monomer including nitrogen atom in aromatic ring lowers degree of polymerization and rises polidispersity index.
- ✓ The preliminary photo-physical and thermal studies have showed evidently that the above mentioned 'synthesis system' worked perfectly without any interference. This study gave important information on the nature of the non-polar backbone and polar side-chain. Consequently, the chemical and photo-physical properties of the polymer products were characterized as linear, regular (*trans*/cis = from 89:11 to 97:3), full-control materials. Linear polymers made from the aromatic norbornene monomers exhibited higher thermo-stability and *T*g than the corresponding aliphatic analogue or block polymers. To the best of our knowledge, these are the first examples of copolymerization *N*-arylens-norbornene-imides and *N*-aliphatic-norbornene-imides by ruthenium initiators. (manuscript in preparation).

We strongly believe these polymers present a new class of polymeric materials whose range of practical applications will be growing very fast, especially in opto- and nanomaterials. Ruthenium catalysts appeared to be quite tolerant to large and bulky *N*-substituent fragments. Their reactivity in polymerization process allows the synthesis of polynorbornene derivatives with unique properties and structures.