**Summary**

The objective of this interdisciplinary research project is to develop novel three dimensional conjugated oligothiophene dendrimers as organic semiconductors with enhanced photon absorbing ability, improved charge carrier mobility and film nanomorphology for organic (bulk-heterojunction) solar cells. Detailed photophysical, morphological, charge transport and device performance investigations will lead to important structure-property-performance relationships. These novel monodisperse macromolecular materials will give important insight in elementary processes of bulk-heterojunction solar cells and thus suggest new ways to produce modern materials with high power conversion efficiency (6-8% expected) in solar cell applications. Special emphasis will be given to the investigation, imaging and control of self-ordering processes in these materials and the resulting morphology of the photoactive layers.
As a new approach, these parameters, which are utmost important for the performance of solar cells will be analyzed and simulated by stochastic algorithms and model-based statistical methods. A model shall be established which describes the morphological structure mathematically. This model will be fitted to real data and lead to predictions which are suitable to synergistically influence the design and application of the materials.
The proposed project is based on an already existing very fruitful cooperation between the physical chemistry group in Eindhoven and the synthesis group in Ulm and would guarantee a highly desirable continuation. Most valuable results have been obtained so far, e.g., the introduction of a novel family of organic semiconductors and their excellent performance in organic solar cells. The implementation and contribution of the mathematical group to the project will further strengthen our integrated approach towards highly efficient bulk-heterojunction solar cells including synthesis, device fabrication to characterization and stochastic model-based simulation.