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Doctoraatsthesis:

CHARACTERISATION OF THERMALLY-INDUCED PHASE SEPARATION IN POLYMER BLEND THIN LAYERS USING CHIP CALORIMETRY AND SPM RELATED TECHNIQUES

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Samenvatting
The aim of this PhD was the fundamental study of phase separation in amorphous polymer blend thin films, using *thermal techniques* that allow a (direct) comparison between phase separation in bulk and in thin films. Two approaches have been followed: '*cantilever-based thermal analysis', and* '*chip-based thermal analysis'*.
Cantilever-based thermal analysis comprises both high temperature atomic force microscopy as a tool to study *in-situ* the morphology development upon phase separation at high temperatures, and local thermal analysis measurements using thermal cantilevers on specific locations of the specimen's surface.
Chip-based thermal analysis, on the other hand, allows the calorimetric measurement of (sub)nanogram samples. A new methodology was developed allowing the construction of the state diagram, and the investigation of the kinetics of mixing/demixing in thin films, evidencing the influence of the increased surface to volume ratio in thin films on the phase separation behavior.

This PhD study showed that both approaches are useful for the monitoring of phase transitions in polymer blend thin layers. Cantilever-based thermal analysis can provide 'microscopic' information on a lateral sub-micron level, while chip-based thermal analysis offers 'macroscopic' information on samples of sub-nanogram level, such as films of a few nm thickness.

Although this is a more fundamental investigation, the developed methodologies can easily be transferred to materials used in real-life applications. Examples are smart stimuli (thermo)-responsive polymer surfaces, protective coatings (with/without self-healing capacity), thermoset coatings or active layers of organic solar cells.