Polymer-Derived Ceramic Nanocomposites (PDC-NCs): Preparative Concepts towards Tailor-Made Phase Compositions and Properties

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Polymer-derived ceramics (PDCs) have been addressed in the last decades and were shown to possess intriguing properties which make them excellent candidates as structural and (multi)functional materials [1,2]. PDCs can be synthesized via polymer-to-ceramic conversion of suitable single-source precursors [3], leading in a first step to amorphous single-phase materials, which subsequently undergo phase separation and crystallization processes to furnish bi- or multi-phase ceramic nanocomposites [4]. In the present work, the conversion of the single-source precursors into PDC, which are of amorphous nature, as well as subsequent phase separation and crystallization processes occurring at high temperatures will be addressed in detail. Special emphasis will be set on describing the intimate relationship between the molecular architecture of the single-source precursors and the phase composition / microstructural features of the resulting PDCs [5-7]. Preparative concepts for the knowledge-based design of PDCs with tailored phase compositions and property profiles as well as selected energy-related applications will be highlighted and discussed.

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