

Perspectives for reactive moulding of PPA as matrix for high-performance composite materials

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ABSTRACT

Perspectives for reactive moulding of PPA as matrix for high-performance composite materials. While Liquid Composite Moulding (LCM) technologies for thermoset composites are increasingly used for manufacturing high quality structural components, LCM technologies based on thermoplastic matrices are still in an early development stage. Reactive thermoplastic LCM processes are up to now applicable only to a few engineering polymers like PA12 and PBT. This work presents perspectives for reactive moulding of the high-temperature resistant polyphthalamide (PPA). Thermoanalytical, rheological and light-optical tests were performed in order to assess the behaviour of low-temperature melting PPA oligomers with increasing temperature and to monitor the polymerisation and crystallisation reactions, which take place at temperatures lower than the melting point of the PPA polymer. The performed tests showed that the raw oligomeric material first undergoes a solid-liquid phase transition at around 135°C. At this stage its behaviour is highly thixotropic and its viscosity lays around 1E4 mPa·s. At higher temperatures the viscosity of the oligomeric melt further drops down, till a first stage of the polymerisation occurs at about 180°C. The end-stage of the polymerisation starts about at 215°C and stops at 297°C. In this stage, the polymer chains crystallise as soon as they are formed, so that the achievable polymers' degree of crystallinity is more than 50% higher than that of melt-crystallised specimens. The melting point of the in-situ polymerised PPA (313°C) is also 3°C higher than that of melt-crystallised specimens (310°C). According to the tests' results, a viable processing technology based on powder impregnated intermediate materials has been proposed.