

## Accepted Manuscript

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PII: S0014-3057(17)31697-X

DOI: <https://doi.org/10.1016/j.eurpolymj.2017.11.019>

Reference: EPJ 8153

To appear in: *European Polymer Journal*

Received Date: 23 September 2017

Revised Date: 4 November 2017

Accepted Date: 11 November 2017

Please cite this article as: Li, M., Bijleveld, J., Dingemans, T.J., Synthesis and Properties of Semi-crystalline Poly(decamethylene terephthalamide) Thermosets from Reactive Side-group Copolyamides, *European Polymer Journal* (2017), doi: <https://doi.org/10.1016/j.eurpolymj.2017.11.019>

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# Synthesis and Properties of Semi-crystalline Poly(decamethylene terephthalamide) Thermosets from Reactive Side-group Copolyamides

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## Abstract

We have prepared semi-crystalline polyamide (PA) thermosets using reactive side-group functionalized copolyamides as precursors. Reactive *meta*- and *para*-based phenylethynyl diacid chlorides (IPE and TPE) were synthesized and incorporated in poly(decamethylene terephthalamide) (PA 10T) using a low temperature solution polymerization method. The phenylethynyl-based comonomers disrupt crystallization of the final copolyamides and lower the onset of melting. Copolyamides containing 5, 10 and 15 mol% of the reactive comonomer could be cured at 350 °C into freestanding PA thermoset films. All thermoset films are stable up to 400 °C, as confirmed by DMTA, which is the result of network formation. The thermosets exhibit both a crystalline phase and a crosslinked amorphous phase. Depending on the concentration of the side-groups, the degree of crystallinity of the final thermosets can be controlled and suppressed by 52-76% compared to the PA 10T reference polymer. Most notable is the fact that the IPE-15 thermoset film exhibits outstanding stress-strain behavior, *i.e.* elongation at break (~17%) and toughness (766 MJ·m<sup>-3</sup>).

Keywords: Side-group functionalized copolyamides; thermal cure; semi-crystalline thermosets

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