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Cross-Linking of Thermoplastics to Improve the Thermo-Mechanical Properties

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Mechanical components made out of plastics conquer constantly new application areas, which were covered so far by metallic materials. According to their applications, the applied materials are increasingly used in ranges of limited conditions (life and temperature, mechanical load). By the increased meaning of plastics for demanding engineering applications e.g. for automotive, medicine and micro technologies as well for electronics, it is necessary to obtain special characteristics for the increase and reliability of the resources and to judge improvement and optimization possibilities.
The cross-linking technology extends the thermal limitations of thermoplastics and improves the chemical resistance. Thermoplastics are cross-linked by means of electron beam irradiation above all the amorphous regions of part-crystalline thermoplastics. This leads to a change of the molecular structure and to an improvement of some mechanical properties, e.g. firmness and creep characteristics, as well as the thermal-mechanical behavior e.g. improved softening behavior, improved thermal stability, and reduced thermal expansion. This effect can be used e.g. for mechanically loaded parts, particularly for micro parts, for which a unfavorable relationship of part surface area to part volume exists to develop the morphology.
The following paper offers an overview of the potentials of radiation cross-linked polyamides. Due to cross-linking in particular the mechanical and thermo-mechanical properties are shifted into a range, which enables the employment of this substrate for application at elevated temperatures. The changes of characteristics as a function of process parameter and geometry are correlated thereby with standard attempts. Besides, the investigations show that cross-linked thermoplastics have fundamentally better long-time properties.