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LOCAL CONTINUOUS FIBRE-REINFORCEMENT – TAILORED INJECTION MOULDING INFLUENCE ON THE MECHANICAL PROPERTIES OF STRUCTURAL THERMOPLASTIC PARTS

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Weight reduction of components is becoming increasingly important, for example in automotiveapplications where significant fuel savings and CO2 emission reduction can be made. In many cases metal load-bearing parts can be replaced by short or long fibre reinforced thermoplastics. These composites have become an integral part of industrial large scale production especially due to their economical processability and increased functionality. The limited mechanical properties, such as stiffness and impact strength, prohibit the use of injection moulded parts in higher load-bearing applications. Furthermore the viscoelastic behavior of the matrix at high temperature or at permanent load is a disadvantage (tendency to creep). Local continuous fibre reinforcement can overcome these disadvantages by increasing the properties and reducing tendency to creep. By analyzing the stress curve of parts with definite dimensions, the structure can be divided into load-bearing and non load-bearing sections. Lines of stress-flux can be identified which show the load gradient inside the injection moulded part. When using short- or long-fibre pellets all areas of the part are equally reinforced by fibres. Due to the higher density of the fibres compared to the matrix the total weight of the component is increased unnecessarily by the reinforcement of reduced or partially unloaded areas. The tailored placement of reinforcing structures with optimal load-dependent orientation along the application-specific load paths reinforces the component only in the areas where extra strength is required and thus increases the weight only partially. This leads to significant weight savings compared to the processing of fibre-reinforced granules. Process description will be explained according to generic and up-scaled specimens. Detailed testing results will show the mechanical behavior regarding to material