Development of a new production technique for an automated integration of RFID technology into plastic parts of thermoplastic and duroplastic material

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Requirements

In times of industry 4.0, in which the cross-linking of the manufacturing gains in importance, technologies with which produced parts can be traced and additional information can be allocated to the products, are of enormous economical and technological interest. Since the RFID (radio frequency identification) technology enables all this, it is currently in the focus of the applicants. [1],[2] At the current state of the art the RFID transponder are integrated manually or at the most semi-automatically into the product or they are applied on the products. Because of this, the product costs reach a level which makes the technology uneconomical for one-time products and low-priced mass products. Moreover, the RFID tags are exposed to all the environmental conditions and therefore not suitable for a long-term usage in almost all applications. The first development of an innovative technique for a fully automated integration of RFID tags into plastic mass products should find a remedy, reduce the production costs and guarantee a media dense encapsulation of the RFID transponders and thereby their protection from external influences and abrasion.

Structure of a RFID tag

Demonstrator tool

Construction, development and usage of the carrier module

Adaption of the fixation and RFID encapsulation technique

In preliminary tests with a hot press, a thermosetting press and an injection molding tool for the production of platelets, the RFID transponders were evaluated corresponding their thermal, pressure and stress resistivity. Laminated RFID transponder were inappropriate since a durable connection between the laminating foil and the plastic material could not be achieved. The un laminated RFID transponder (125 kHz) were promising because they withstood the stresses during the injection molding process. However, the module should be fixed at the coil to enhance the probability of a functioning RFID tag after its integration into the plastic part. Even at this project stage it became clear, that the stability of the filament HF tag (13.56 MHz) with NFC (near field communication) function has to be improved.

Fixation in the cavity with a C-profile

Further enhancement by agglutinated tags and a carrier module

A carrier module was developed, in which the NF-RFID tags are inserted and on which the HF-RFID tags are coiled. This carrier module preserved the form of the coil and enables the integration of the filament transponders into plastic parts made of high viscous and abrasive materials filled with glass fibers, maintaining the functionality of the transponder. Injection molding experiments with various materials and fixing methods showed that the amount of functioning RFID transponders increases when the tags are agglutinated or the carrier modules are used. Moreover, the usage of the carrier module facilitates the automated integration of the RFID tags into the plastic parts.

References


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