REACTIVE MOLDING OF ELASTOMERS IN 3D PRINTED MOLDS FOR ROBOTIC ACTUATORS

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Actuators are a key component of robotic systems. Material and shape of such robotic fingers are main factors for durability and gripping strength. The fingers are injection molded. Thus, finger mold and material development should be done together. Up to now, development time has been largely determined by mold construction. To enable faster development cycles, new methods of rapid prototyping molding of elastomers will be presented.

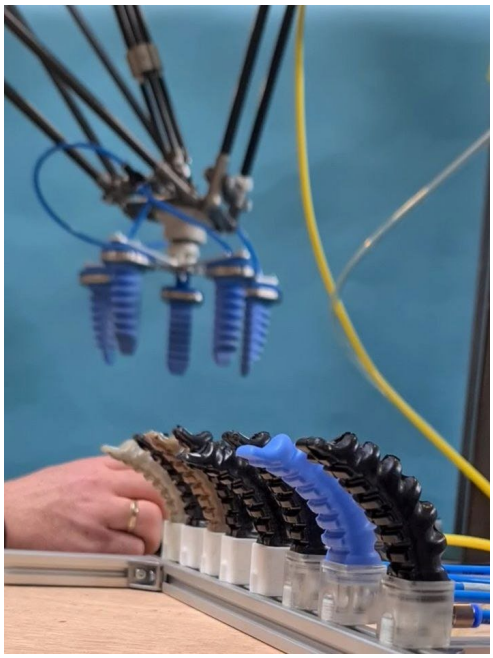

Figure 1 - Mechanical tests of soft actuators

In industry, reactive injection molding machines press elastomers like silicones and rubbers into molds at high pressure. For rapid testing of rubbers, horizontal compression molding has been used, in which the material is preformed and placed in the mold for compression and vulcanization. Further knowledge of a rubber-product-system is obtained with a combination of rheological and practical methods. Standard methods include tensile strength, hysteresis, Shore hardness and MDR. These are linked to practical analytical values, such as pressure-to-strength and pressure-to-bending characteristics, bulging over time, and cycles until failure durability tests of actuators. This enables to reach viable systems much faster.

While the compression molding process produces good results for existing molds, a new metal mold must be produced for each new variant of products in an expensive and time-consuming process. To minimize costs and time, new molds for liquid silicone injection have been produced using mSLA (Masked Stereolithography). Now shapes can be rapidly prototyped and tested with low viscosity polymers.

Combining both worlds – material that requires extrusion and 3D-printed molds – simplifies the study of shape-material interactions and thus reduces the time to market for new rubber products. So far, this method works excellent for hollow molds that can withstand pressure due to an external metal structure. The next step is to create a viable procedure for inserts that will allow co-development of form and material for hollow rubber actuators.