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## **The Applications of Nano-materials in Micro Injection Molding**

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The miniaturization of components has been progressing rapidly due to developments in micro electronics, optoelectronics, and biotechnology. Recently, the use of plastic materials with added fillers has become a potential alternative due to their versatility and the ease of batch fabrication. This paper investigates the formability and wear abrasion of the polymer with added nano-powders, 10 to 30 nm in diameter, during micro injection molding. One mold with 4 cavities is used to illustrate the filling behavior and accuracy of the micro parts. The IC micro feature can illustrate the formability of the polymer with added nano-powders. Experiments showed that shrinkage was significantly reduced when the nano-powder content was increased. The polymer with 30% ZnO nano-powder content showed 58.3% less in shrinkage compared to pure PP. One mold with 4 parts and the micro feature were successfully manufactured using a custom-made micro injection machine when nano-powders were added to the polymer. However, the micro feature with added fillers, which had a diameter of 10  $\mu\text{m}$  and a length of 10 to 30  $\mu\text{m}$ , could not be duplicated through micro injection molding. In addition, a nano ceramic material, such as ZnO, improved wear resistance by 70% when nano particles were uniformly dispersed in the polymer and a suitable surfactant solvent was chosen.