

Micro/Nano and Precision Manufacturing Technologies and Applications

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Abstract:

The demand of high-performance parts and devices continually increased in the field of machinery, electronics, energy and medicine. The size of these parts and devices has reached to micro- and nano-scale. The shape and structure of these parts and devices became more complex and precision. In addition, the requirement for machining accuracy and material scope increased continually. Therefore, this is remarkable important to develop powerful manufacturing technologies to satisfy the requirements of these high-performance parts and devices.

In this work, four types of micro/nano and precision manufacturing technologies and their applications investigated in our group will be discussed. (1) Cross-scale manufacturing technology. This technique was explored especially for the M/NEMS devices with the characteristics of micro-nano cross-scale such as microfluidic chips and micro heat pipe of LED. (2) Electrohydrodynamic jet (E-Jet) print-patterning. This technology enables the material and structural composited controllable fabrication in nano scale layer. This technology can also be used for the fabrication of complex microstructures. In addition, this technique enables the printing of structure in micro and sub-micro scale resolution. This technique has been used for the fabrication MEMS device such as micro fuel cell and high frequency piezoelectric ultrasonic transducer. (3) Ultra precision grinding and chemical mechanical polishing technologies. A new ultra precision and low damage grinding technology with soft abrasive grinding wheel was developed, which has the capability to obtain the ultra smooth and low damage ground surface wafer. A full-automatic grinder for 300 mm wafer was also developed. (4) Structural health monitoring for major equipment. A force sensing system for structural condition monitoring of high speed railway rail was developed. This force sensing system has been applied in Beijing-Tianjian high speed railway and National Railway Track Test Center.

Keywords: Micro/nano manufacturing, Precision manufacturing, M/NEMS devices