〔電気システム工学〕

34-30 "The piezoelectric elements for the non-resonance type motor using a shear deformation mode"

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Recently, various types of linear ultrasonic motor are investigated. However, they are so compact. So, the non-resonance type piezoelectric actuator has been proposed by Uozumi er al. (Fig 1.). This actuator is using a shear deformation mode. It can move unlimitedly an object toward both side.

The piezoelectric constant of the shear deformation mode (d_{15}) is usually larger than d_{33}. On the other hand, the shear deformation is occurred by applying electric field vertically against poling direction. The electrodes for poling must be removed before using. If its polarization is reduced, we can not re-polarize. So it must be paid attention not to reduce polarization.

In this study, $Pb_{0.925}Sr_{0.05}Mn_{0.125}Nb_{0.25}Zr_{0.255}Ti_{0.37}O_{2.975}$ was chosen. Its $d_{15}=1000\times10^{-12}$(m/V) and Curie temperature is 180(degree Celsius). The polarization of this composition reduces easily by applying high temperature (under Curie temperature) with high pressure or mechanical damage (slicing).

The piezolelctric element for this type motor, stacked 4 shear mode plates (thickness=0.6㎜), was made. Its displacement is largely influenced by its stacking process. The shear displacement is 1.5-1.8um by applying +/-145V. The elements were assembled to a motor for the ultra-precision stage and evaluated. It can move 20kg object. The maximum velocity of the stage is 120(mm/sec). The settling time for the +/-10nm opsitioning is less than 30ms(Fig 2).