A novel fabrication for surface microstructures on silica glass

Two types of new apparatuses for surface micro-fabrication of UV transparent materials, based on AIST-original LIBWE (laser-induced backside wet etching) method, have been developed. One is an excimer laser mask projection system, and another is a diode-pump solid state laser beam scanning system. Both systems can micro-fabricate a silica glass surface of large area rapidly, and high aspect ratio of 60 was attained in a deep trench fabrication. Unlike conventional lithography methods, these apparatuses need no photo-resist, and can be operated under atmospheric pressure. The projection system attained 0.75 µm resolution and the beam scanning system can fabricate prototypes rapidly.

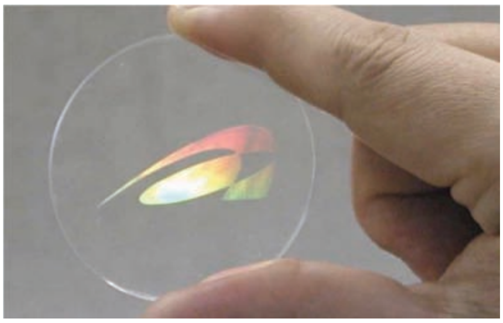

Figure: Line patterned grating fabricated by laser beam scanning system using galvano mirrors.
(Color image on silica glass is obtained by visible light scattering with the grating)

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Conduction Mechanism in Semiconductor Spintronic Device Clarified

Novel TMR (Tunneling Magneto-Resistance) devices composed of single-crystalline semiconductors with (Ga,Mn)As for ferromagnetic electrodes and ZnSe for tunnel barrier, were developed. The spin-dependent transport properties of the TMR devices were studied in detail. It has been confirmed with the semiconductor-based TMR devices that (i) large TMR effects can be obtained just like with the metal-based TMR devices, and (ii) anisotropic TMR effects reflecting hole characteristics of semiconductors can be demonstrated in contrast to the metal-based TMR devices. The results verify holding and transfer of spin information in semiconductor spintronic devices. This research will open the way to realization of spin transistors.

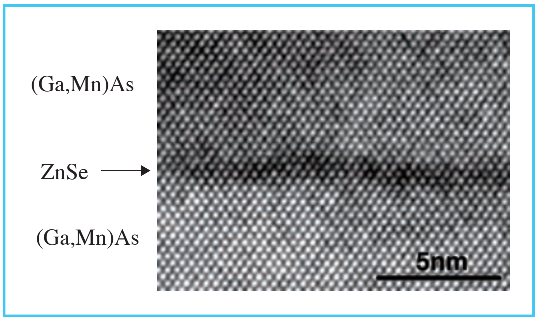

Figure: A cross section transmission electron microscope of single-crystalline semiconductor TMR device consisting of (Ga,Mn)As and ZnSe.

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