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**Regulating spin and Fermi surface topology of a quantum metal film by the surface (interface) monatomic layer**

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Spin and current controls in solids have been one of the central issues in researches of electron and spin transport. Nowadays, electronics/spintronics deals with nanometer- or atomic-scale structures and miniaturization of these systems implies emergence of various quantum phenomena, intimately linked to the formation of electronic states different from those of the corresponding bulk materials. For example, valence electrons of films with the thickness comparable to the electron wavelength form discrete quantum-well states (QWSs) under opportune conditions of confinement (quantum size effect). Furthermore, the size reduction also increases the surface/volume ratio and a film possibly changes its electronic (spin) properties by the surface effect. Concerning metal films, the quantum size effect requires the thickness in a range of nanometers and the length corresponds to several tens of atoms, indicating the very large ratio of a surface (interface) monatomic layer to film atomic layers. Thus, we have been interested in combining the quantum size effects and the surface effect on the metal films to induce new physical phenomena. In the present talk, two research cases are shown. 1) Instead of isotropic two-dimensional in-plane states expected for an isolated metal film, quasi-one-dimensional quantized states were measured by photoemission spectroscopy in an epitaxial Ag(111) ultra thin film, prepared on an array of atomic chains [1]. 2) High-resolution spin-resolved photoemission and magneto-transport experiments of ultrathin Ag(111) films, covered with a /3×/3-Bi/Ag surface ordered alloy, were performed. The surface state (SS) bands, spin-split by the Rashba interaction, selectively couple to the originally spin-degenerate QWS bands in the metal film, making the spin-dependent hybridization [2,3]. Magnetoconductance of the films, measured in situ by the micro-four-point probe method as a function of the applied magnetic field [4], has shown that the formation of the Rashba-type surface alloy reduces the spin-relaxation time in the ultrathin film significantly [5]. These results demonstrate that spin and Fermi surface topology of a quantum metal film can be regulated by the surface (interface) monatomic layer.

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