ATOMIC SCALE INTERMIXING IN NANO-SCAL MULTILAYER

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ABSTRACT

As the thickness of thin films for modern devices have approached to a few nanometer scale, it is very important to understand thin-film-growth mechanisms on the atomic scale. For the devices composed of nano-scale multilayers, its performance largely depends on the atomic structure of the interface. Evolution of the interfacial structure in an atomic scale is thus a fundamental issue to improve the performance of the devices. In the present work, deposition behavior of Co-Al system was investigated at room temperature by a molecular dynamics simulation. Even when the incident energy of the deposited atom is very small (i.e. 0.1eV), severe intermixing occurs when Co atom is deposited on Al substrate. Three monolayers of CoAl B2 structure exist at the interface. On the other hand, Al deposition on Co substrate resulted in an atomically sharp interface without any atomic intermixing. This asymmetry will be discussed in terms of kinetic barrier for intermixing and local acceleration of the deposited atoms near the substrate surface. Using the asymmetric behavior, we could suggest a simple method to obtain a novel spin-valve structure.