The Study of the Electronic and Crystalline Structures and Magnetic Properties of Fe/C_{60}/Cu(001)

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Although several particular effects on hetero material have been investigated by many groups, there have been fewer attempts to understand the mechanism of their interface. If the advantages of the hetero-interface considered, the electronic structure at interface should be very important because the electronic structure directly affects the charge transport in organic application devices and hybridization between hetero materials. Hence, our main scientific aim is to explore the electronic structure at hetero-interfac

To study the properties of hetero-interface, we perform the electronic properties at interface between Fe and long range ordering C_{60} film by using XPS. The spectrum of Fe 3p, C 1s and valence band are shown in Fig. 6. Only a very tiny chemical shift can be observed for Fe 3p peak which is actually smaller than the energy resolution. For the main peak of C 1s, the spectrum shows same tendency. However, a new peak shows up with binding energy lower than C 1s main peak can be clearly detected when the thickness of Fe is higher than 3 ML. Since the diameter of C_{60} is 7 A and the interlayer distance of Fe is around 1.8 A from our previous study, this new peak may due to the chemical bonding between Fe and the top of C_{60}. Furthermore, from the evolution of valence band with increasing thickness of Fe, one can also find a gap state which is just lower than Fermi level if the thickness of Fe is again higher than 3 ML. This peak can be understood in terms of hybridization 3d and 2p orbitals interaction of Fe and C_{60} top surface. That means the LUMO state of C_{60} mixes with Fe 3d and so that induces such gap state just lower Fermi level. Such strong chemical interaction may result in different and interesting magnetic ordering of Fe at interface.