# The effect of the MgO(001)layer on CuPc-based organic spintronic devices

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Spin transport phenomena in organic semiconductors (OSCs) hasbeen explored actively fordevelopingnext-generation memory devices based on various advantages of OSCs[1,2]. One of the major hindrancesin this organic spintronic field is to control interface properties between OSCs and ferromagnetic metals (FMs) forimproving the device efficiency.

In this work, we focus on the effect ofthin MgO(001) layer onthe interface properties of FM Fe and OSC Cu-Phthalocyanine (CuPc). Systematic studies of spin-dependent transport were performed in Fe(001)/ MgO(001)/CuPc/Co magnetic tunnel junctions (MTJs) with an1.6 nm thick MgO and thin CuPc films of various thicknesses (0 ~ 5 nm). We observed tunneling magneto-resistance (TMR) higher than 200% at 77 K in MTJs with 1~2 nm thick CuPc layers. However, no MR was observed in Fe(001)/CuPc/Co structure without the MgO layer. In order to understand the effect of the MgO(001) layer on spin transport, we studied polymorphs of the CuPc molecules by Raman spectroscopy. While CuPc molecules of the 1$^{st}$ monolayer strongly adsorb on Fe(001) surface, subsequent molecules have different polymorphs. These surface analysis results indicate thatthe structure ordering of CuPc molecules could be strongly related to competition between interface (surface) interaction and intermolecular interaction. Thus, CuPc molecules on MgO(001) form the rather well-ordered structure due to the predominant intermolecular interaction than the CuPc/ MgO(001) interface interaction.

## References

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