# キャッピング層による $SrTiO_3$ 界面の電気伝導度制御

## Capping layer effect on conductivity at $SrTiO_3$ interfaces

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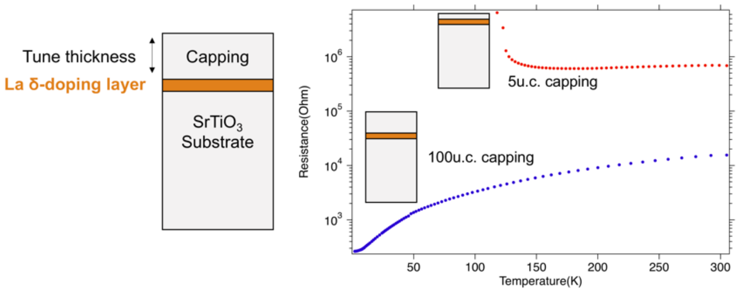
The intriguing physical behavior of two-dimensionally confined electrons in transition metal oxides have been studied mostly in the $LaAlO_3/SrTiO_3$ system, but similar interfacial quantum wells can be created by delta-doping $SrTiO_3$ with La or oxygen vacancies. Several interesting experimental techniques have been developed in recent years to study 2D electron systems, such as laser PEEM and laser ARPES [1,2]. However, these techniques are quite surface sensitive and cannot be used for probing deeply buried interfaces. This is a particularly severe problem for delta-doped $SrTiO_3$ systems because the large dielectric permittivity of $SrTiO_3$ implies that the interface must be separated from the surface by a thick cap layer.

In this work, we study the effect of the cap layer thickness on the transport behavior of La delta-doping layers embedded in $SrTiO_3$. We aim to determine how the electron confinement and the depth distribution of carriers are affected by the vicinity of the cap layer surface. As shown in the Figure, a metal-insulator transition occurs when the cap layer thickness is reduced below a few unit cells. We use transport and Hall analysis to probe the carrier depth distribution for thin cap layers and attempt to develop a capping regime that allows surface-sensitive electronic structure probes like ARPES and PEEM to be used while maintaining the metallic 2D carrier confinement.




[Figure] Heterostructure design and the effect of the capping layer thickness on the conductivity of the delta-doped interface layers.

**[References]**

[1] Y. Motoyui, T. Taniuchi, P. Scheiderer, J. N. Lee, J. Gabel, F. Pfaff, M. Sing, M. Lippmaa, R. Claessen and S. Shin, *J. Phys. Soc. Jpn*. **88**, 034717 (2019).

[2] Y. Ishida, H. Kanto, A. Kikkawa, Y. Taguchi, Y. Ito, Y. Ota, K. Okazaki, W. Malaeb, M. Mulazzi, M. Okawa, S. Watanabe, C.T. Chen, M. Kim, C. Bell, Y. Kozuka, H.Y. Hwang, Y. Tokura, and S. Shin, *Phys. Rev. Lett.* **107**, 077601 (2011).