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Tuning the carrier density at SrTiO3/LaAlO3 interface by La1-xSrxMnO3 capping layer YUJUN SHI, DI WU, Physics Departmen,Nanjing University — The observation of a high-mobility quasi-two-dimensional electron gas (q2-DEG) at the interface between the insulators of SrTiO3 (STO) and LaAlO3 (LAO) has gained significant attention in recent years. The carrier density at these interfaces is usually tuned by controlling the growth conditions or applying an electric field in a three-terminal device. According to the polar catastrophe model, which is used to interpret the origin of the q2-DEG at the LAO-STO interfaces, the carrier density and the critical thickness of LAO for the metallic interfaces are related with the net charge of LaO and AlO2 layer in LAO. Here, we systematically study the growth of La1-xSrxMnO3 (LSMO-x), whose net charge is 1-x in each layer, on LAO ($<$ 4 u.c.)/STO to tune the interfacial carrier density and critical thickness. For LAO (3 u.c.)/STO, we found that the threshold thickness of LSMO (x=0.33) for the observation of q2-DEG is 2 u.c. The LAO (3 u.c.)/STO interfaces show a metal-insulator transition for x between 2/3 and 7/8. Importantly, the carrier density monotonically decreases as increasing Sr doping. Our results strongly support the polar catastrophe model and provide a new approach to tune the interfacial carrier density..

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