Quasi-2*D* *d*-spin ordering in a 3*D* Fe perovskite studied by Resonant Soft X-ray Scattering

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Fe perovskite $La_{1/3}Sr_{2/3}FeO_3$ shows charge disproportionation, where average $3Fe^{11/3+}$ ions are separated into Fe^{3+} and Fe^{5+} with the ratio of 2 by 1 [1]. Neutron scattering revealed that charge ordering appears along [111] direction with the 3-hold period and spin density wave orders along the same direction with the 6-hold period [2]. We investigated charge and magnetic transitions in charge disproportionation of perovskite $La_{1/3}S_{r2/3}FeO_3$ thin film by hard X-ray scattering and resonant soft X-ray scattering at Fe L_3 edge. Temperature-dependent measurements reveal that $La_{1/3}Sr_{2/3}FeO_3$ exhibits anomalous two-domain transitions of spin-charge ordering of Fe 3*d* spins (and O 2*p* holes) in the 3*D* Fe perovskite. Upon cooling, the formation of the ferromagnetic and charge-disproportionated Fe^{3+}-O-Fe^{5+}-O-Fe^{3+} trilayers precedes the development of 3*D* magnetic order.

References

[1] M. Takano *et al.*, J. Solid State Chem. **39**, 75 (1981).
[2] P. D. Battle *et al.*, J. Solid State Chem. **84**, 271 (1981).