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Formation of mesoscopic metallic filaments in manganite thin films imaged by microwave impedance microscopy WORASOM KUNDHIKANJANA, KEJI LAI, YONGLIANG YANG, YUE MA, MICHAEL KELLY, ZHI-XUN SHEN, Stanford University, MASAO NAKAMURA, ZHIGAO SHENG, MASASHI KAWASAKI, YOSHI TOKURA, RIKEN, Japan, STANFORD UNIVERSITY COLLABORATION, RIKEN, JAPAN COLLABORATION — We study the ferromagnetic metallic domains from the charge-order insulating background at mesoscopic length scale in a Pr0.55Ca0.75Sr0.25MnO3 thin film using a variable temperature microwave impedance microscope (MIM). The metallic state in this compound can be easily induced at a moderate magnetic field as low as 2 T observed by both the transport and MIM. The temperature dependent transport under 1.2 T shows a large hysteresis loop. MIM allows us to observe the formation and melting of metallic domains at different temperatures during the cooling and warming processes. At higher temperatures, the metallic domains first emerge in small isolated filaments along certain crystal axes of the LSAT(110) substrate, suggesting that the local strain plays an important role. Surprisingly, small insulating islands remain in the metallic ground state and persist up to very high magnetic fields, indicating strong pining sites. Lastly, the sizes of the insulating islands at the ground state increase when the film is field cooled at lower speeds, suggesting s glassy order in this compound.

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