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Gate-tunable charge density wave in TiS_3 nanoribbons CE HUANG, ENZE ZHANG, XIANG YUAN, WEIYI WANG, YANWEN LIU, CHENG ZHANG, JIWEI LING, SHANSHAN LIU, FAXIAN XIU, Fudan Univ — Recently, modifications of charge density wave (CDW) in two-dimensional (2D) limit show intriguing optical and electrical properties in quasi-2D materials such as layered transition metal dichalcogenides (TMDCs). However, the CDW in quasi-1D materials like transition metal trichalcogenides (TMTCs) is yet to be explored in low dimension whose mechanism is likely distinct from their quasi-2D counterparts. Here, we report a systematic study on the CDW properties of titanium trisulfide (TiS3). Two phase transition temperatures were observed to decrease from bulk and thin nanoribbon, respectively. It is believed that the nanoribbon structure increases the fluctuation effect across the chain and thus destroys the CDW coherence. Remarkably, by using back gate in 15 nm device, we can tune the second transition temperature largely owing to the altered electron concentration. Laser beams on the sample surface is exploited to manipulate the CDW transition, where the melting of the CDW states shows a strong dependence on the excitation energy. Our results demonstrate TiS3 to be a promising quasi-1D CDW material and open up a new window for the study of collective phases in TMTCs.

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