Monolayer MXene (transition metal carbide/nitride) for superconductor

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INTRODUCTION: MXene, as a new member of the two-dimensional (2D) material family, has increasingly gained its popularity in the research field. Due to its fascinating properties such as excellent conductivity, controllable surface chemistry, and mechanical strength, it shows promising applications in a wide variety, including energy storage, sensor, catalysis as well as electromagnetic shielding. The superconductivity studies about 2D MXenes has also become an attractive research area, where Mo_2C and Nb_2C were predicted theoretically to exhibit outstanding superconductivity properties. The MXenes with unique structures could achieve high transition temperature, making them superior superconductivity candidates to other 2D materials. The in-depth investigation and understanding in experiment are still in the very early stage.[1-4]

RESULTS: Different from what was reported previously, here we developed an optimized synthesis method for preparing MXene (e.g., Nb_2C) with high quality. The as-synthesized MXene can be exfoliated into monolayer counterpart and homogeneously dispersed in polar solvent due to the present of terminal groups. The MXenes with different lateral sizes from micrometer scale down to nanometer scale were obtained and can be uniformly deposit on any substrate including the silicon wafer for further modification and testing.

DISCUSSION & CONCLUSIONS: Devices for electrical transport characterization including their superconducting properties are under fabrication and optimization. The goal of our research is to theoretically and experimentally reveal the underlying superconductivity mechanisms of monolayer MXene, and further to improve its superconductivity properties, which could result in potential technological applications.

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