Wettability of MXene: A Comprehensive Study

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Titanium carbide $Ti_3C_2T_x$ is the most studied 2D nanomaterial from the MXene family. One of the highlighted properties of $Ti_3C_2T_x$ compared to other nanomaterials is its hydrophilicity as a result of the presence of polar surface functional groups T_x. The most common method to determine the hydrophobicity or hydrophilicity of the material is a contact angle measurement. However, the measurement of the static contact angles (CAs) using a sessile drop method has been criticized in numerous articles due to a huge random effect and are therefore not necessarily reproducible [1]. As a result, for MXenes, static CAs have been reported in the literature and their values lie in a broad range from 18 to 91 degrees [2].

In this work, $Ti_3C_2T_x$ –water interactions on different silicon substrates were investigated. Advancing (highest measurable) and receding (lowest measurable) contact angle measurements, providing reproducible contact angle values were performed. The effect of the background substrate to the wetting behaviour of MXene was investigated and the contact angles of MXene monolayer were compared with 2 and 3 monolayers [2].

The advancing contact angle on MXene on both substrates was independent of the number of MXene layers, showing a negligible effect of the background substrate wettability. The advancing contact angle values (77-80°) were surprisingly high and close to the value published for graphene (93°). However, a low value of the receding contact angle (26-27°), resulting in the estimated most stable contact angle value of 57°, proves the hydrophilic character of MXene compared to graphene. The giant contact angle hysteresis observed should be considered as an important factor responsible for the broad range of water contact angles in the literature. This study provides a comprehensive understanding of the wettability of MXene [2]. The fundamental knowledge of MXene surface behaviour could be utilized in many applications and multicomponent systems.

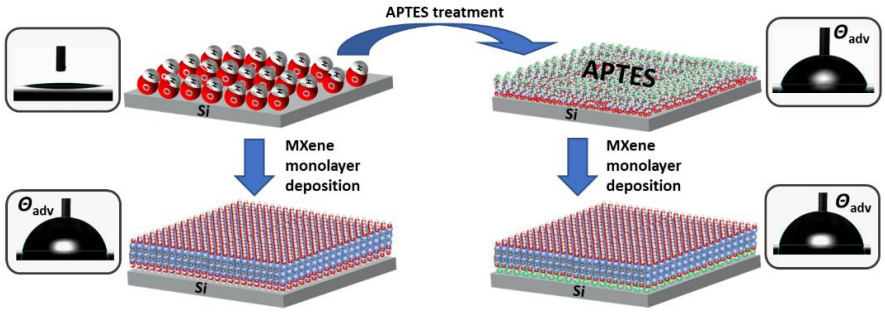

Fig. 1. Scheme of preparation of MXene monolayers and corresponding contact angles.

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References

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