Novel MXene based materials as acid catalysts

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MXenes are a novel class of carbides/nitrides that were first synthesized in 2011. They are prepared by exfoliating MAX phases, which are layered carbide/nitride materials. Recently, we reported Ti$_3$AlC$_2$ MAX phase as a heterogeneous catalyst for selective oxidation of butane (Angew. Chem. Int. Ed. 2018, 130, 1501–1506). We have now discovered that Ti$_3$C$_2$Tx MXene derived from this MAX phase is a good catalyst for the liquid-phase alcoholsysis of styrene epoxide. (Figure 1a)

The surface acidity due to the presence of –OH and –F groups on the MXene makes it a good catalyst for this acid-catalyzed reaction. Interestingly, we were also able to control the selectivity by modifying the catalyst surface. For example, we treated MXene with water to form a thin layer of titania which changed the activity and selectivity significantly. (Figure 1b) Surprisingly, pure titania showed little to no reactivity, which shows the importance of surface interaction between the MXene and TiO$_2$.

![Figure 1](image)

Figure 1: (a) Schematic representation of the Ti$_3$C$_2$TiO$_2$ composite synthesis and (b) SEM images of both Ti$_3$C$_2$ and Ti$_3$C$_2$TiO$_2$ materials and their corresponding kinetic data in the alcoholsysis of styrene epoxide.


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