MAX phase and MXene Materials as Catalysts for Carbon Dioxide Hydrogenation
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Abstract

The hydrogenation of carbon dioxide to formaldehyde is an important reaction, since it uses CO2 as a feedstock and it produces the most important aldehyde in industry. This reaction can be performed at room temperature and is therefore much more efficient than the current process to form formaldehyde. Ti3AlC2 MAX phase and Ti3C2 MXene are new materials that due to their ceramic and metallic properties are presented as promising materials for heterogeneous catalysis. For this reason, we tested for the first time in literature both MAX phase and MXene in CO2 hydrogenation. The materials were characterized by XRD, SEM and TGA. We found that MAX phase is stable at high temperatures (up to 800 °C) but the MXene structure decomposes at 550 °C. Nevertheless, both compounds remain stable for at least 20 hours of reaction at room temperature. They have been utilised as both catalysts and as supports for low wt% impregnation of platinum. The impregnated PtO/MAX phase appears to be more active than PtO/MXene, and it also shows higher activity than other catalysts reported in literature.