

Tribological performance evaluation of $Ti_3C_2T_x$ Mxene as lubricant additive in presence of organic friction modifier

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Abstract

Mxenes, a type of two-dimensional material (2D), have drawn substantial attention because of their exceptional ability to reduce friction and wear. MXenes have emerged as an important group in tribological study owing to their exceptional physical, chemical, and mechanical characteristics, shearability, and ability to form protective tribofilms. This study investigates the use of multilayer $Ti_3C_2T_x$ Mxene as a friction modifier additive to enhance the lubricating properties of PAO base oil. In this research, a reciprocating tribometer was used to study the frictional performance, followed by wear measurement by white light interferometry, surface analysis by transmission electron microscope, atomic force microscope, and scanning electron microscope. It investigates the effects of introducing an organic friction modifier (GMO) and an anti-wear ingredient (ZDDP) into the lubricant mixture. The results indicate that the combination of PAO oil, GMO, Mxene, and ZDDP demonstrates a significant decrease in the coefficient of friction (COF) and wear, attaining roughly 40% and 35% reductions, respectively, when compared with base oil. The improved performance is due to the formation of a tribofilm that contains elements from the additives present in the lubricant. This novel lubricant blend not only efficiently reduces friction but also exhibits substantial potential for use in demanding working circumstances.