The Ecolefins Project: Tetragonal Tungsten Bronzes for Electrode Applications

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Light olefins are used in abundance, and for a wide range of purposes, in the petrochemical industry requiring production of vast quantities which is reported to emit ~400 megatonnes of CO_2 per annum.[1] The Ecolefins project[2] aims to establish technology that will consume atmospheric CO_2 while simultaneously producing light olefins, in a manner that can be fully powered by renewable energy sources. In doing so, the heavy emissions of this process can be reversed, creating a carbon negative means of producing light olefins. This will be done by developing membrane reactors, designed to drive the reduction of CO_2 to light olefins, and so electrode materials which are compatible with this process are required.

Tetragonal tungsten bronzes (TTBs), general formula $A2_4A1_2B1_2B2_8C_4O_{30}$, have gathered attention in recent years for their promise in energy materials applications. In particular, they show potential for use in energy harvesting and capacitor applications among others, owing to the observation of thermoelectric and ferroelectric properties in several different TTB compositions. Such scope of applications is possible due to the chemical and structural flexibility observed in TTBs, which arises as a result of the presence of several distinct cation sites.

Excluding a few studies some time ago, there has been limited work on investigating the potential of TTBs as electrode materials.[3, 4] We report our recent work in this area, where our preliminary studies build on previous work, with a focus on exploiting the flexibility of the TTB structure to achieve the desired properties for these applications.

References

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