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Alkali titanates as a bride for solid state chemistry and soft matter

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Alkali titanates including the Andesson-Wadsley type $A_2O{\cdot}nTiO_2$ (A = alkali) and the lepidocrocite-type $A_xM_yTi_{2-y}O_4$ are diverse in crystal structure, composition, and microstructure including microcrystals or nanotubes. They are composed of tunnels or sheets of corrugated, double edge-shared $(Ti,M)O_6$ with varying lengths of such motifs, depending on the alkali-to-Ti ratio. The tunnel or the interlayer space allow many interesting physical properties such as ion/proton conduction, positive temperature coefficient of resistivity (PTCR) effect, etc. They also exhibit rich chemistry including intercalation, proton exchange, exfoliation, and reassembling, which are absent in denser alkaline titanate such as the $BaTiO_3$ perovskite. The nanosheets derived from layered alkali titanates display interesting dielectric properties with potential applications as pressure sensors and triboelectric nanogenerators (TENG). These materials therefore serve as a bridge for solid state chemistry and soft matter which is to be presented here.

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