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Stabilisation of iron-oxo dimers in a natural layered clay for efficient photocatalysts comparable to TiO_2

Because solid photocatalysis is a (potentially) feasible means of tackling environmental and energy issues, research into even a pioneering solid photocatalyst, TiO_2, is still growing. In addition, the development of solid photocatalysts alternative to TiO_2 has been burgeoning due to its cost-ineffectiveness, environmental and health concerns.[1,2] A ultimate alternative to TiO_2 is naturally-occurring photocatalysts; however, few reports have demonstrated natural materials showing photocatalytic activities higher than or comparable to that of TiO_2. Here, we report a simple method to stabilise otherwise fleeting iron(III)-oxo dimers by intercalating them into the interlayer space of a natural layered clay.[3] Comprehensive analyses and calculations reveal that the Fe^{3+}-oxo dimers are stabilized via direct coordination to the silicate layers, with sufficient interlayer void space for reactant accessibility. The resulting material exhibits an excellent photocatalytic activity toward the oxidation of formic acid in water and formaldehyde in air comparable to the benchmark TiO_2 (P25) photocatalyst. This approach offers a sustainable pathway to design efficient, earth-abundant, and structurally tunable photocatalysts.

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