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A new microporous oxyfluorinated titanium(IV) phosphate as an efficient heterogeneous catalyst for the selective oxidation of cyclohexanone

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Abstract

Designing a new porous nanomaterial for eco-friendly catalytic reactions is very challenging. Here, a new crystalline microporous oxyfluorinated titanium phosphate material (TIPO-1) has been synthesized under hydrothermal conditions in the absence of any structure directing agent. The triclinic crystalline phase with the unit cell parameters $a = 7.962 \text{ \AA}$, $b = 10.006 \text{ \AA}$, $c = 13.979 \text{ \AA}$, $\alpha = 96.921^\circ$, $\beta = 95.851^\circ$ and $\gamma = 93.760^\circ$ has been indexed for TIPO-1 and it has been characterized through powder X-ray diffraction, nitrogen adsorption/desorption, XPS, FT-IR, ^{31}P MAS NMR spectroscopy, UHR-TEM, FE-SEM and TGA/DTA analysis. The material exhibited excellent catalytic activity in liquid phase partial oxidation of cyclohexanone to adipic acid (upto 92% conversion) in the presence of aqueous H_2O_2 as oxidant together with value added side products like 1,6-hexandial and ϵ -caprolactone for reactions in different solvents. The material showed excellent recycling efficiency for six consecutive reaction cycles without any significant loss in catalytic activity.

Keywords: Titanium phosphate; microporosity; triclinic phase; liquid phase selective oxidation; adipic acid synthesis.

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