Layered Hydrazinium Titanate, LHT-9: Synthesis and Applications

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A new nanocrystalline titanate has been synthesized under mild conditions using recently reported fluoride route [1,2]. The compound relates to a family of layered titanates with the crystal structure derivative of lepidocrocite (γ-FeOOH) structure type. Its chemical composition corresponds to the formula $(N_2H_5)_{0.5}Ti_{1.87}O_4 \cdot nH_2O$. The compound has a characteristic interlayer *d*-spacing of 9.5 Å and thus hereinafter is referred to as LHT-9 (Layered Hydrazinium Titanate - 9 Å). Due to unique combination of reductive properties inherited from parent hydrazine, ion exchange properties of its layered titanate structure and nanoscale size of its particles, LHT-9 is an effective cation-free sorbent for many chemical elements. The inert TiO_2-based matrix allows using LHT-9 in acid, neutral and alkali solutions yelding stable insoluble sorption products. A typical time required to complete sorption varies between 15 min and 1 hour. LHT-9 can be applied in numerous fields of industry, including:

1. Treatment of both acid and alkaline liquid nuclear waste simultaneously removing ^{99}Tc, ^{90}Sr, ^{137}Cs, ^{107}Pd, ^{93}Zr, ^{79}Se, ^{126}Sn, ^{151}Sm, ^{155}Eu, ^{113}Cd as well as actinides. The obtained sorption products are ready-to-use precursors for one-step preparation of stable titanate-based ceramics: a convenient and cheap alternative for borosilicate glass and SYNROC technologies.
2. Reductive extraction of noble metals (Rh, Pd, Ir, Pt, Au) from industrial solutions.
3. Preparation of TiO_2/Se nanocomposite, an excellent sorbent for Hg vapors stable up to 300 °C and thus suitable for removal of mercury from hot combustion gases.

The study of unique properties of LHT-9 is in progress expecting its new unusual industrial applications.

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References

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