Titanium dioxide nanoneedles

EXECUTIVE SUMMARY

A simple one step process for producing pure rutile titanium dioxide nanoneedles at room temperature with high aspect ratio and high morphology control. Potential applications in paints, coating, as photo catalysts, etc.

BACKGROUND

Titanium dioxide (TiO_2) occurs in nature as rutile, anatase and brookite. Rutile is the most common and most stable form and has wide ranging applications. Producing pure rutile TiO_2 has been very time-consuming or cost-intensive or both. Also, it was very difficult to control the morphology of the resulting product.

TECHNOLOGY DESCRIPTION

NCL's technology involves a one-step electrochemical process for the synthesis of pure rutile TiO_2 nanoneedles, with high aspect ratio, at room temperature. Nanoneedles with aspect ratio of ≥10 can be produced with very good control over the morphology of the resulting TiO_2

MARKET POTENTIAL

- Large market potential with high growth rates- TiO_2 market is expected to top $2.3 billion by 2012** and annual growth rate in India is expected to be around 8-10%*
- Nano-TiO_2 sells at a very high premium over bulk TiO_2; Nano-TiO_2 is sold anywhere between $176 to $198/kg ***
- Raw titanium ores currently trade between $0.09 and $0.51/kg,
- Processed bulk TiO_2 trades at approximately $2.21/kg
- Increasingly, more and more nano- TiO_2 is expected to be used in place of bulk TiO_2

* http://www.icis.com/v2/chemicals/9076546/titanium-dioxide/uses.html, ** http://www.nanotech-now.com/news.cgi?story_id=30032, *** Estimates of Upper Bounds and Trends in Nano-TiO2 Production As a Basis for Exposure Assessment, Environ. Sci. Technol., 2009, 43 (12), pp 4227–4233

VALUE/ADVANTAGES

- Less energy intensive (process carried out at room temperature)
- Ability to synthesize phase-pure rutile TiO2
- Reduced time for synthesis (as this process avoids any formation of intermediate amorphous powder or anatase phase and hence doesn't need heat treatment to from rutile TiO2)
- Easier, cheaper, quicker process (when compared to previous methods of synthesis)

APPLICATIONS

Rutile TiO2 is widely used as/in

- UV protecting agent
- In optical coatings
- Beam splitters
- Anti-reflection coating
- Humidity sensor
- High-temperature oxygen sensor
- Photo-catalyst
- Biomedicine

TECHNOLOGY STATUS

- Demonstrated at the lab scale
- On the lookout for potential partners for spin-off and licensing
- Patent applications filed: Indian #- 0049/DEL/2009; PCT #- IN2010/000022

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