Additive Manufacturing of High-Refractive-Index, Nanoarchitected Titanium Dioxide for 3D Dielectric Photonic Crystals

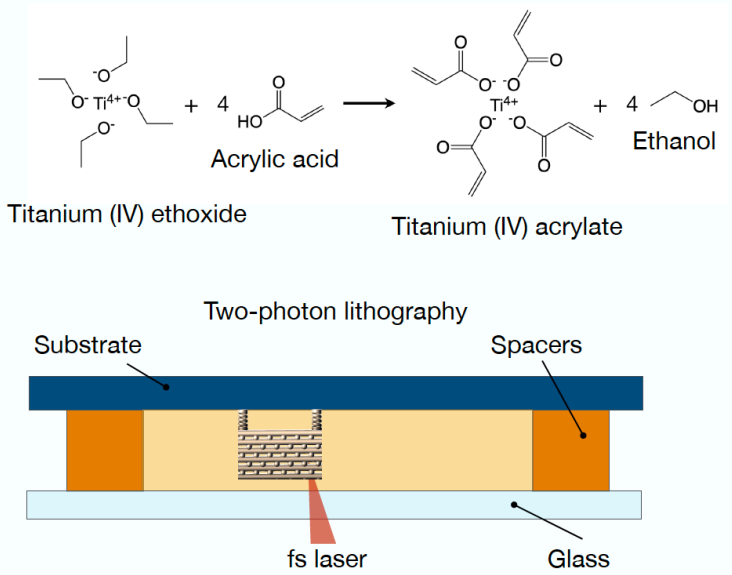
A. Vyatskikh, R.C. Ng, B. Edwards, R.M. Briggs, J.R. Greer. (2020) *Additive Manufacturing of High-Refractive-Index, Nanoarchitected Titanium Dioxide for 3D Dielectric Photonic Crystals.* ACS Nano Letters, 20, 5, 3513–3520. DOI: https://doi.org/10.1021/acs.nanolett.0c00454

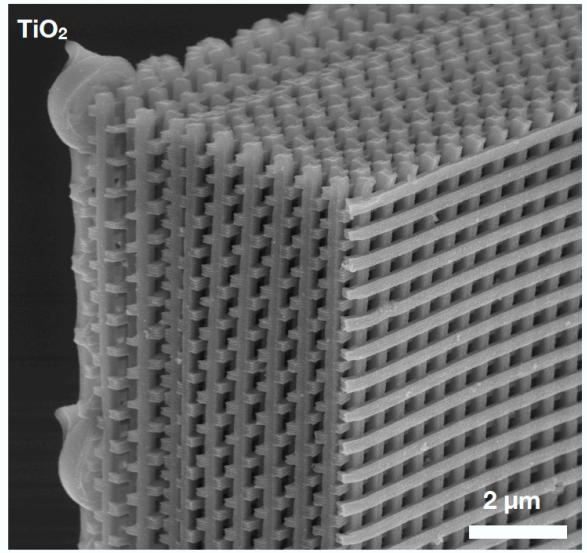
Scientific Achievement

- Developed an additive manufacturing (AM) process for titanium dioxide (titania, TiO_2) with ~100 nm resolution

Significance and Impact

- AM of 3D nanoarchitected titania will enable facile fabrication of components for micro-optics, 3D MEMS, minimally invasive tools and procedures, and photocatalysis





Process for nanoscale additive manufacturing (AM) of titanium dioxide (left) and SEM characterization of as-fabricated TiO_2 3D architectures (right)

Technical Details

- 120-600 nm features with <1% porosity
- Rutile phase of nanocrystalline TiO_2 w/ 120nm grain size
- Process precision allowed to fabricate 3D dielectric photonic crystals with full photonic bandgap in the infrared

Caltech | RESNICK INSTITUTE science + energy + sustainability