Self-assembled TiO$_2$ foam-like films, were grown by the water based Streaming Process for Electrodeless Electrochemical Deposition (SPEED). The morphology of the 1 m thick films consists of a tangled ropy structure with individual strands of 200 nm diameter and open pores of 0.1 to 3 micron dimensions. Such films are advantageous for proposed perovskite solar cell comprising CH$_3$NH$_3$PbI$_3$ absorber with additional inorganic films as contact and conduction layers, all deposited by SPEED. Lateral film resistivity is in the range 20 $\Omega$ 200 k $\Omega/cm$, increasing with growth temperature, while sheet resistance is in the range 2 $\Omega$ 20 $\Omega/Sq.$

X-ray diffraction confirms presence of TiO$_2$ crystals of orthorhombic class (Brookite). UV-vis spectroscopy shows high transmission below the expected 3.2 eV TiO$_2$ bandgap. Transmittance increases with growth temperature. This is a Ropy TiO$_2$ thin film. We prepared Smooth TiO$_2$ and Evaporated TiO$_2$ thin film. Self-assembled TiO$_2$ film deposited by aqueous-spray deposition was investigated to evaluate morphology, crystalline phase, and infrared optical constants. The 130 nm thick film has Anatase nano-crystalline structure with 10 nm characteristic surface roughness sparsely punctuated by defects of not more than 200 nm amplitude. The film is highly transparent throughout the visible to wavelengths of 12 $\mu$m. The optical band gap was determined to be 4.18 eV. Important for long-wave infrared applications is that dispersion is weak compared with the more commonly used dielectric in planer structures SiO$_2$. The low-cost, large-area, atmospheric-pressure, chemical spray deposition method would allow conformal fabrication on flexible substrates for long-wave infrared (LWIR) photonics.

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The public is welcome to attend.