Electronic Supporting Information

Synthesis:

Titanium tetrachloride (99.99%, Aldrich) was used without further purification. Dichloromethane was dried by distillation over P_2O_5. Cotton wool was purchased from TETRA Medical. Ferula pith was taken from ferula communis samples collected near Montpellier. Both cotton wool and ferula pith were dried in an oven at 120 °C for 24 h prior to use.

CTi-400 and CTi-700 samples: dried cotton wool (3 g) was put in a 90 mL Teflon-lined autoclave. Then $TiCl_4$ (1.75 g) diluted with anhydrous CH_2Cl_2 (17.5 ml) was added under inert atmosphere and the autoclave was sealed and heated in an oven at 150 °C for 7 days. After reaction the autoclave was opened, the liquid was removed and the black fibers were washed 3 times with 40 mL of anhydrous CH_2Cl_2 then dried overnight in air. Then the sample was dried under vacuum at 110 °C for 4 hours (sample $CTiO_2$) and calcined in dry air for 2 hours at 400 °C (sample $CTiO_2$-400) and then for 2 hours at 700 °C (sample $CTiO_2$-700) (heating rate 5 °C/min).

FTi-400 and FTi-700 samples: dried ferula pith (1 g) was put in a 90 mL Teflon-lined autoclave. Then $TiCl_4$ (4.7 g) diluted in anhydrous CH_2Cl_2 (47 ml) was added under inert atmosphere and the autoclave was sealed and heated in an oven at 110 °C for 8 days. We used a reaction temperature lower than in the case of cotton because the thickness of the cell walls in ferula pith (ca 1 µm) is significantly lower than the diameter of the cotton fibers (ca 5-15 µm). After reaction the autoclave was opened, the liquid was removed and the black solid was washed 3 times with 40 mL of anhydrous CH_2Cl_2 then dried overnight in air. Then the sample was dried under vacuum at 110 °C for 4 hours (sample $FTiO_2$) and calcined in air for 2 hours at 400 °C (sample $FTiO_2$-400) and then for 2 hours at 700 °C (sample $FTiO_2$-700) (heating rate 5 °C/min).

Characterization:

Scanning electron microscopy (SEM) images were obtained with a HITACHI-S4800 electron microscope. The X-ray powder diffraction patterns were obtained with a XPERT PRO diffractometer using Cu Kα radiation (λ=1.5405 A°). The BET specific surface area of the particles was measured by nitrogen sorption at 77 K on a Tristar (Micromeritics) sorptometer. Prior to the measurements, the samples were degassed under vacuum at 150 °C for 12 hours. The specific surface area was determined from the adsorption isotherm in the 0.05–0.30 P/P_0 range using the BET method. The pore size distribution was derived from the desorption branch using the BJH method.

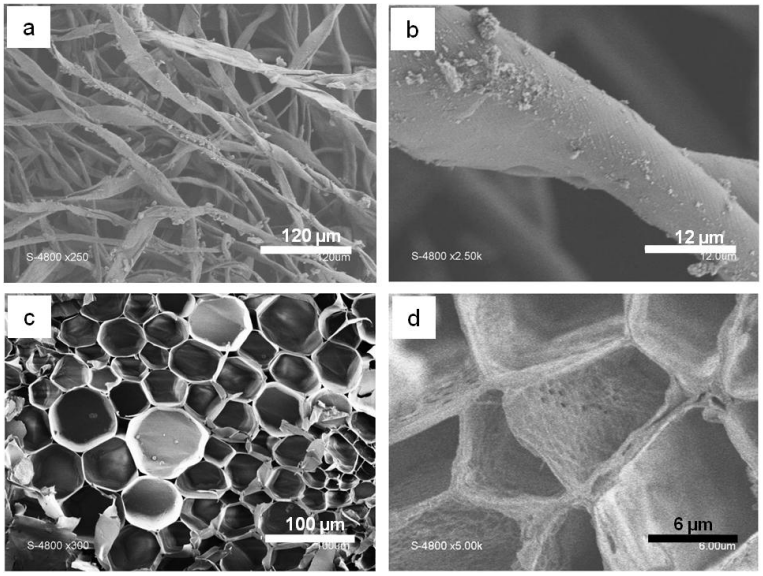

Fig. S1: SEM images of the starting materials cotton wool (top) and ferula pith (bottom). a): large-area image of cotton wool showing the presence of long fibers; b) enlarged view of a fiber; c) large-area image of ferula pith showing the cellular structure with cells ca 10-70 µm in diameter and d) enlarged view showing the interior of small cells.

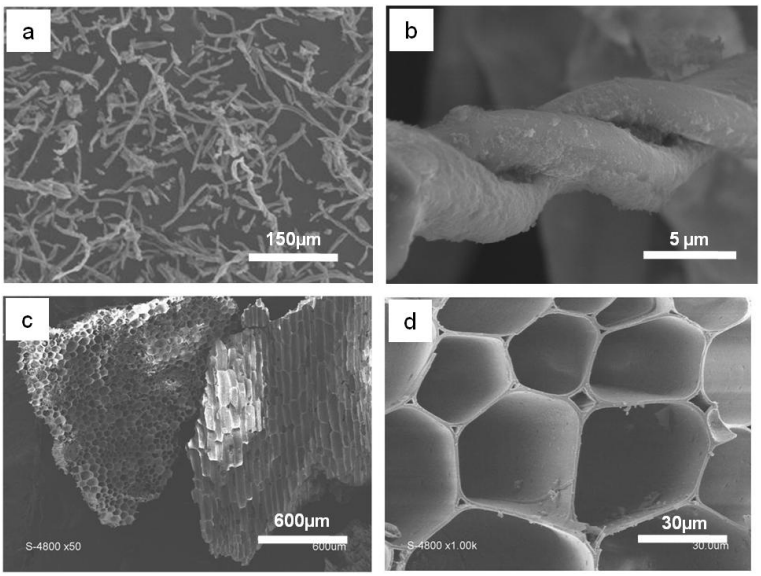

Fig. S2: SEM images of uncalcined samples $CTiO_2$ (top) and $FTiO_2$ (bottom) obtained by reaction of $TiCl_4$ with cotton wool and ferula pith, respectively. a): large-area image of $CTiO_2$ showing the presence of broken fibers; b) enlarged view of a fiber; c) large-area image of $FTiO_2$ showing the preservation of the cellular morphology and d) enlarged front view showing the polygonal cells.

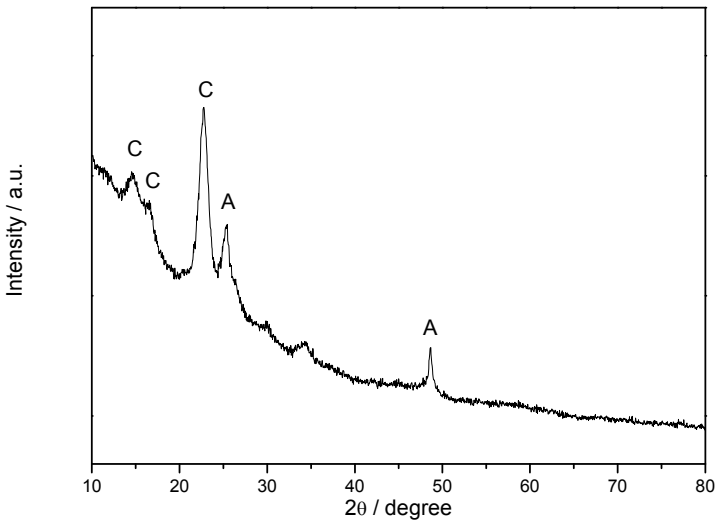

Fig. S3. X-ray powder diffractogram of $CTiO_2$ before calcination, showing the formation of TiO_2 anatase ((peaks labelled A) and the presence of remaining crystalline cellulose (peaks labelled C).

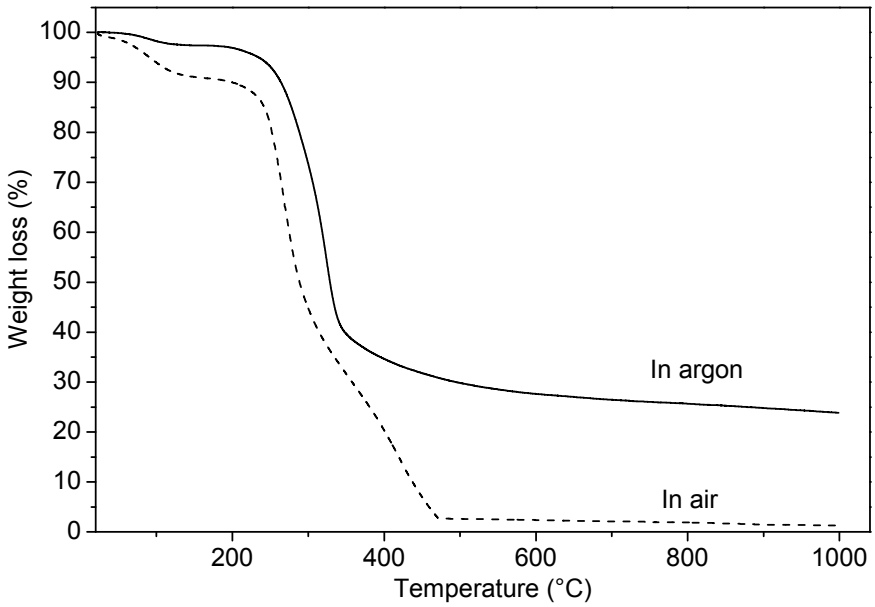

Fig. S4 : Thermogravimetric analysis of cotton in air and argon

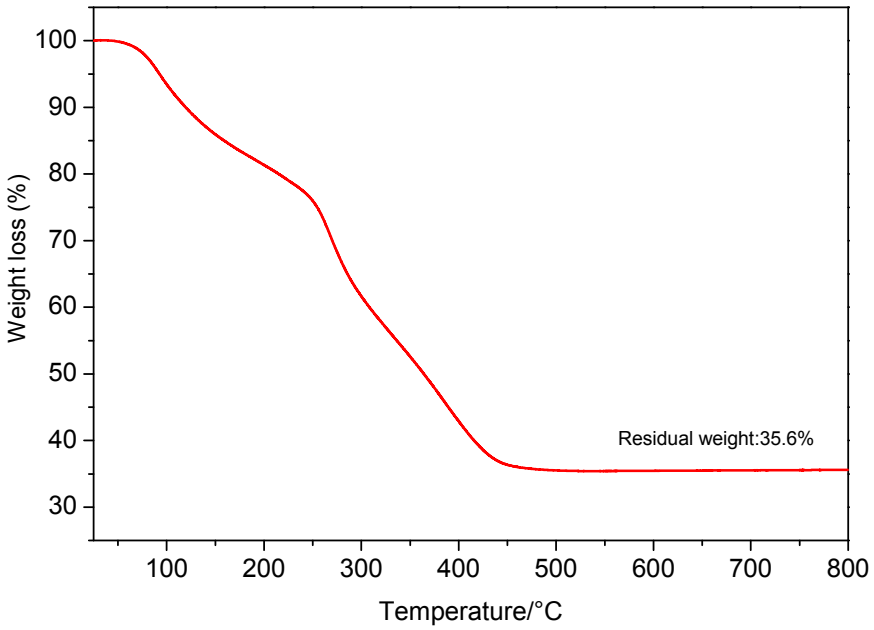

Fig S5 : Thermogravimetric analysis of $CTiO_2$ in air