Supplementary Information to paper

A PVA-brookite composite: the effect of plasma pre-treatment on the thermal, mechanical and photochromic properties

Anastasia Evdokimova[1], Valeria Shibaeva[1], Nikolay Sirotkin[1], Anton Kraev[1], Anton Manakhov[2], Anna Khlyustova[1]*

[1] G. A. Krestov Institute of Solution Chemistry of RAS, Ivanovo, Russia, 153045
[2] Research Institute of Clinical and Experimental Lymphology—Branch of the ICG SB RAS, Novosibirsk, Russia, 630060
*Correspondence: avlada5577@gmail.com

S1 Sol preparation

4.5 g of PVP (M_W=55 000) dissolved in 100 mL of distilled water heated to 80ºC. Next, 6 g of citric acid was added and stirred until completely dissolved. Heating stopped after adding 2.5 ml of titanium isopropoxide. The synthesis proceeded for 48 hours. Complete dissolution of the white flakes and clearing of the solution indicate the end of the process.

S2 Sol's characterization

X-ray diffraction experiments were carried out on a diffractometer with a Mo-Kα source (λ = 0.07107 nm) (Bruker D8 Advance) with an attachment for registering liquid samples in the range of 2Θ=4–40° with a step of 0.02°. The zirconium β filter was used for monochromatisation of radiation. A VÅNTEC-1 position-sensitive detector (Bruker) was used to register the intensity of scattering from the samples.

Information on the phase composition of TiO_2 sols before and after plasma treatment was obtained via XRD patterns (Figure S1). All the peaks belong to the brookite phase (JCPDS 29-1360). There are no peaks related to other phases or impurities. A change in the intensity of the main brookite peaks is noted at 12.4° and 24.1°. This means the formation of lattice structure defects due to the incorporation of metal ions (doping). Therefore, plasma treatment leads to the doping of titanium dioxide.

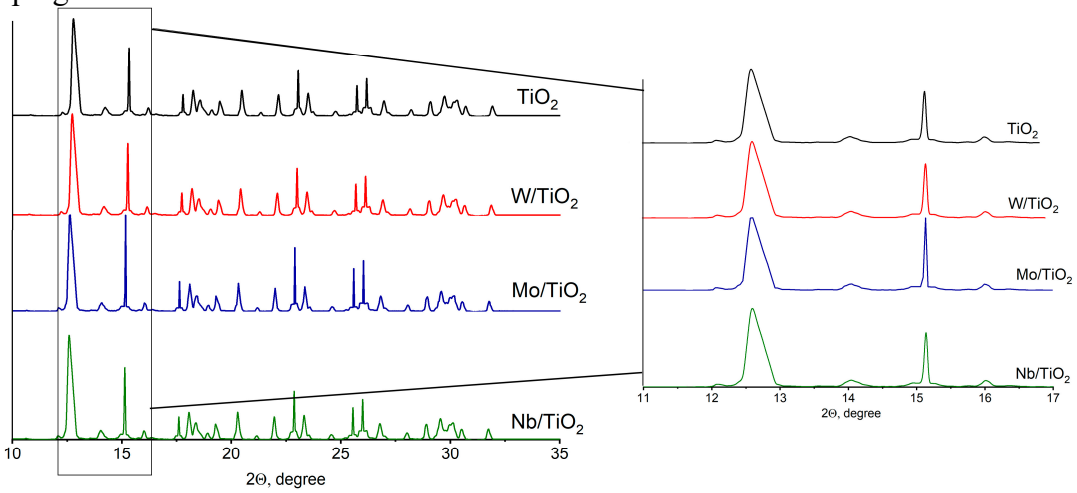

Fig. S1 XRD patterns of TiO_2 sols before (sample 1) and after plasma treatment (samples 2-5) with different electrode's material

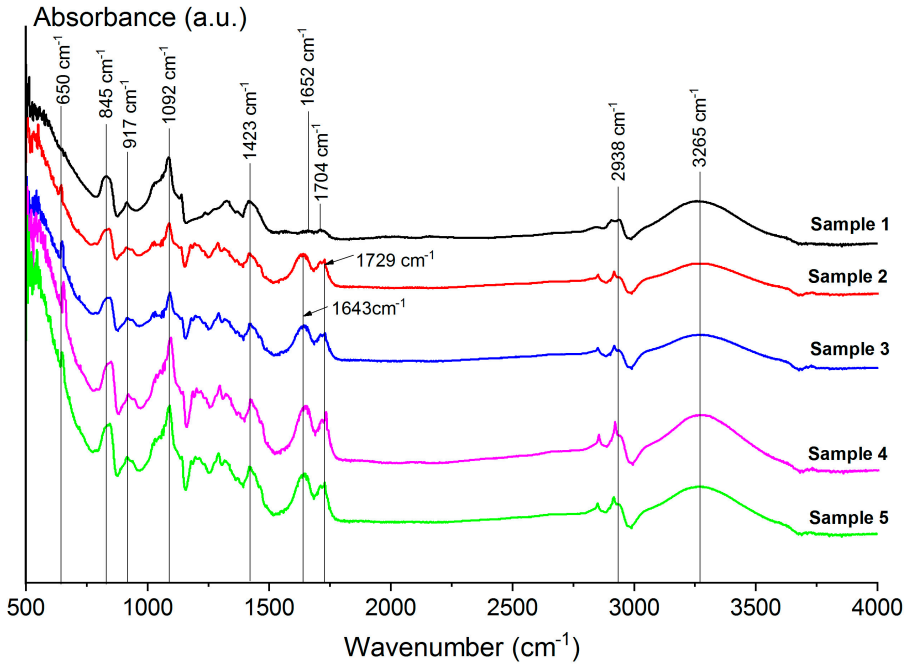

Fig. S2. FTIR spectra of obtained composites

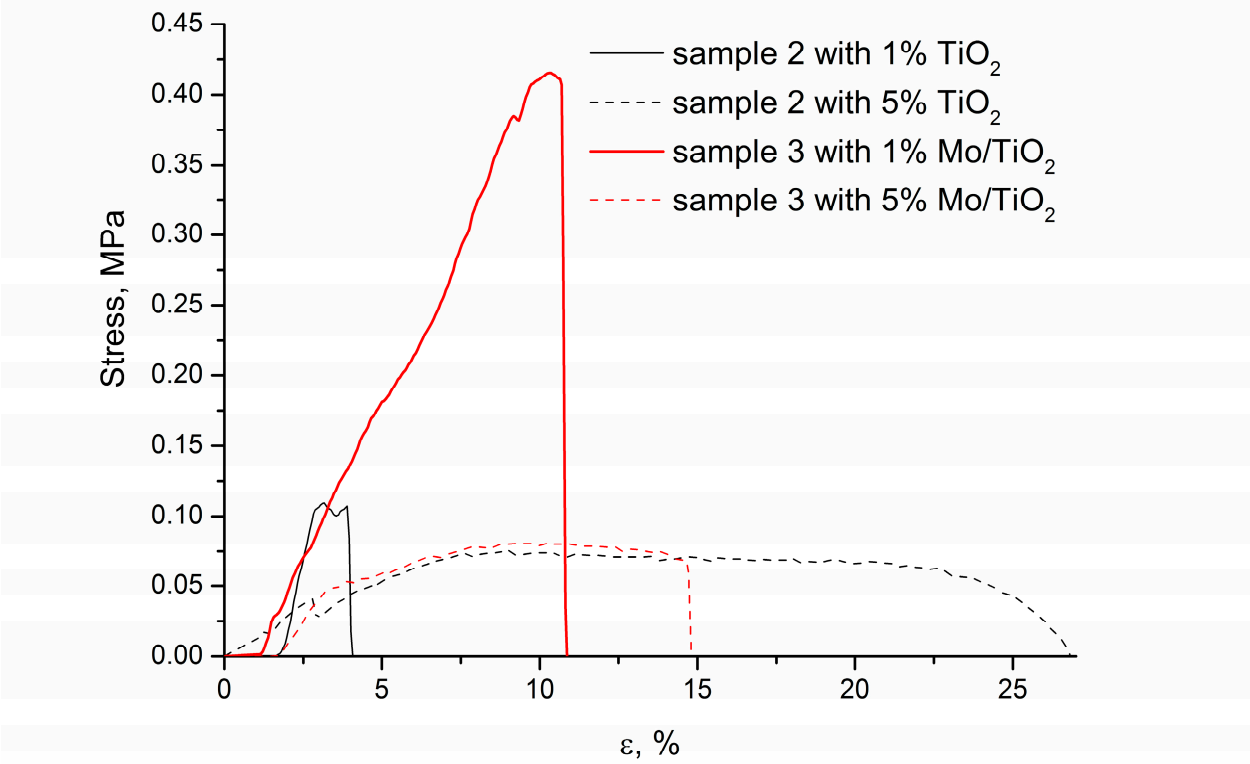

Fig. S3. Effect of filler's concentration on the mechanical properties of polymer composites (samples 2 and 3 as examples)

Table S1 Mechanical properties of composites with 5% fillers

Sample	Stress, MPa	Young's modulus, MPa	Elongation at break, %
1	3.17	2.78	11.2
2	0.07	1.20	22.6
3	0.08	0.52	15.0
4	0.07	0.07	14.3
5	0.07	0.72	19.3

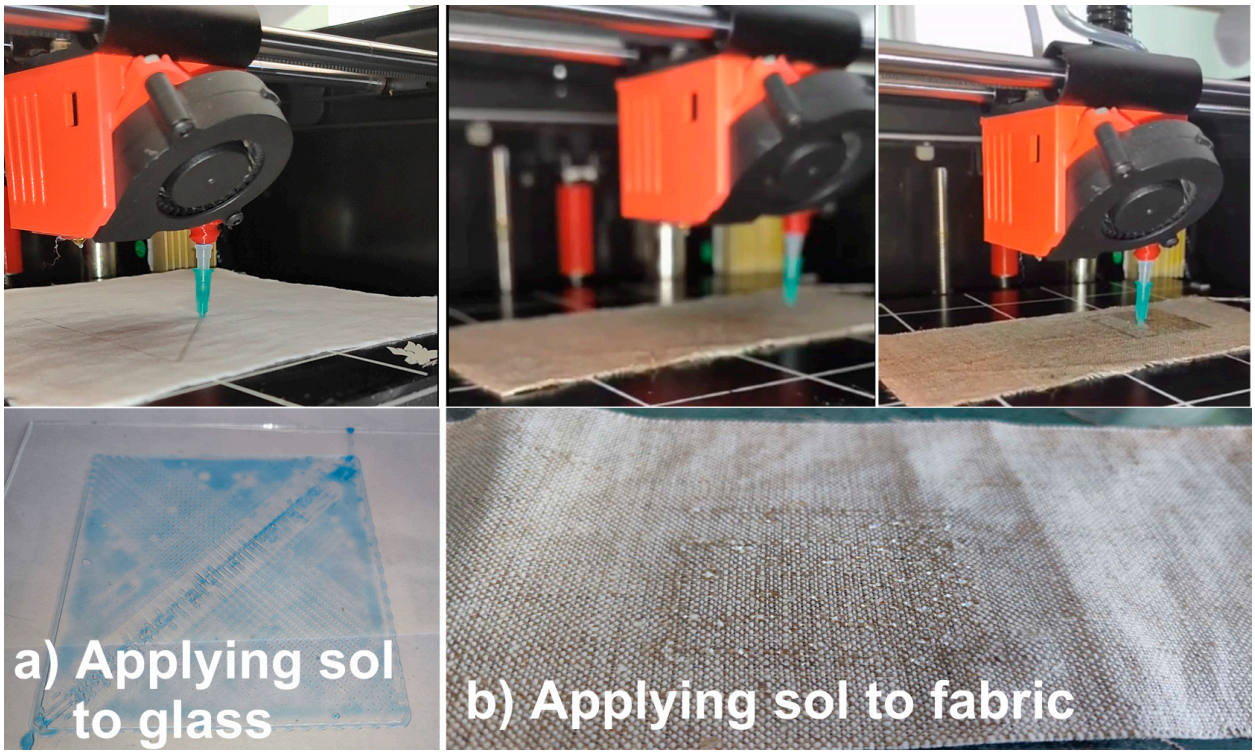

Fig. S4 Example of using PVA-brookite composite as ink for 3D printer