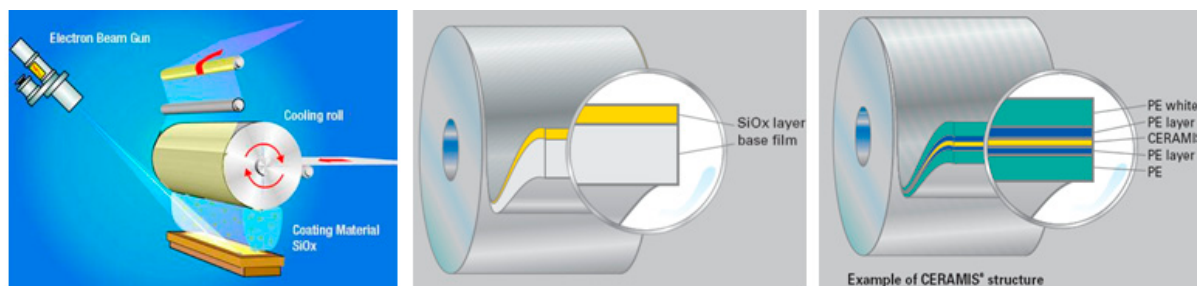


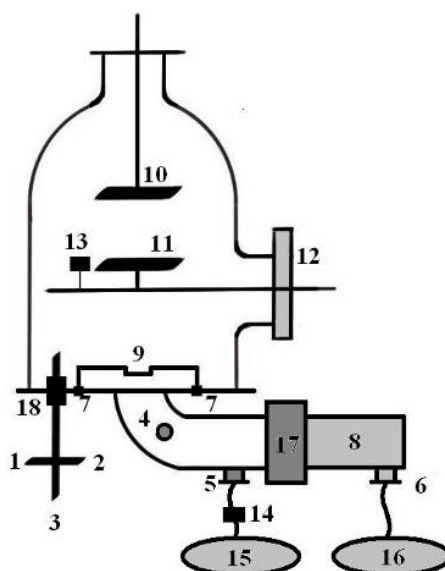
# Protective Properties of A Microstructure Composed of Barrier Nanostructured Organics and SiO<sub>x</sub> Layers Deposited on A Polymer Matrix

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Supporting Information

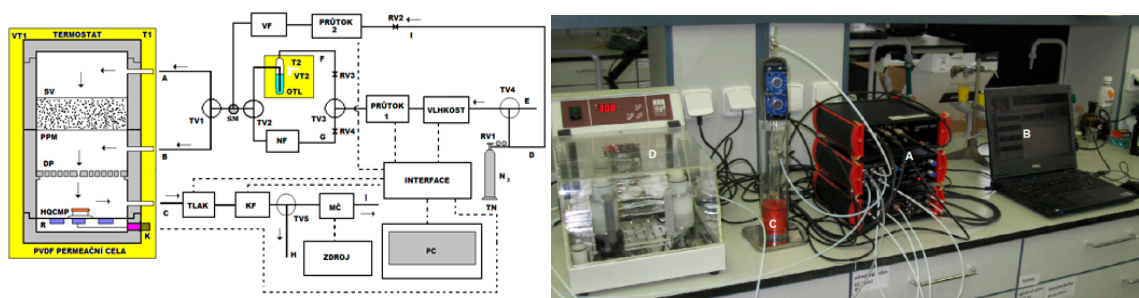


**Figure S1.** The principle of CERAMIS reactive steam technology and examples of SiO<sub>x</sub>® coated materials

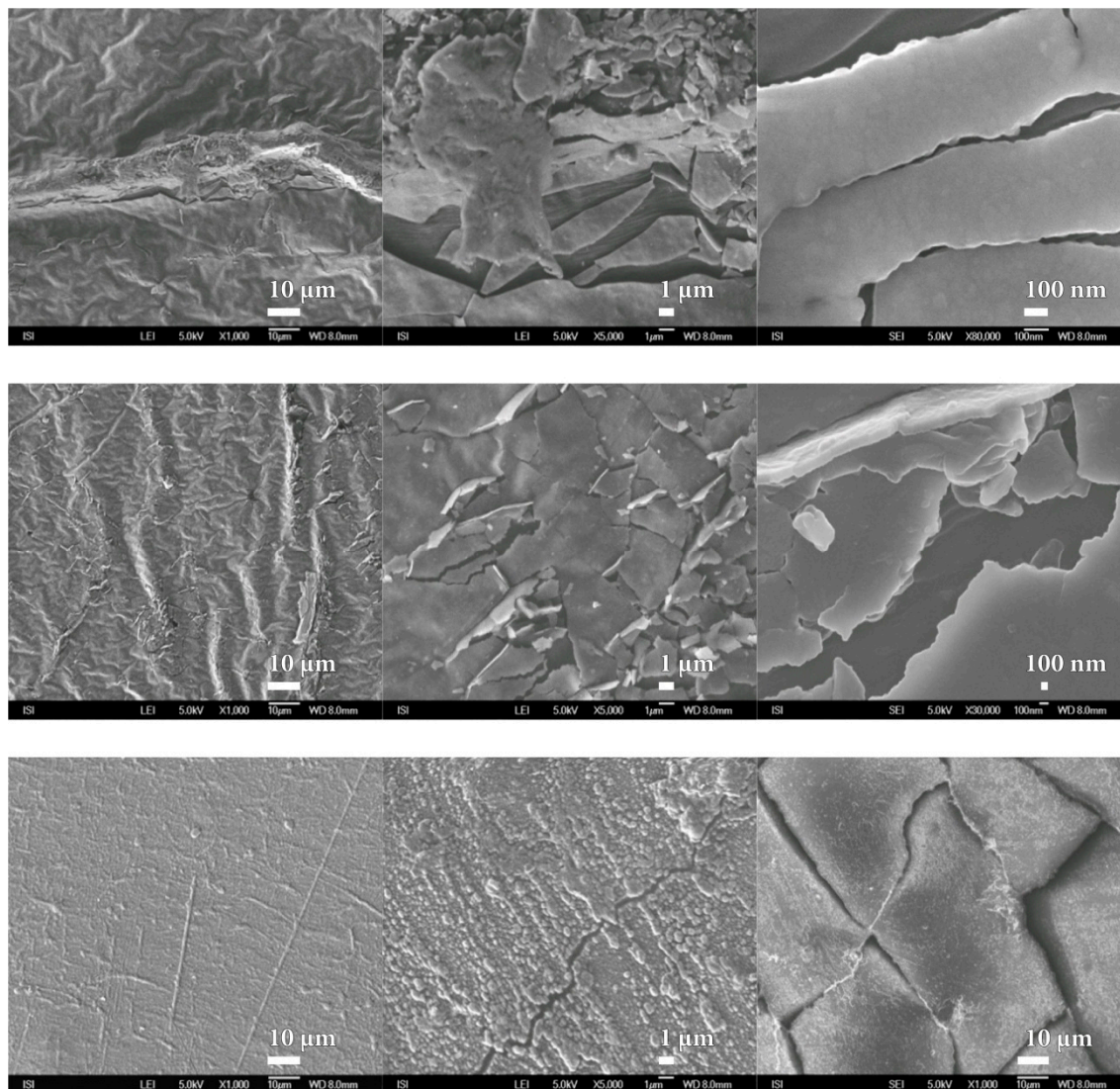


**Figure S2.** The scheme of the PE-CVD/PA-PVD apparatus for the preparation of SiO<sub>x</sub> nanocoatings SiO<sub>x</sub> with steaming from powder SiO in vacuum

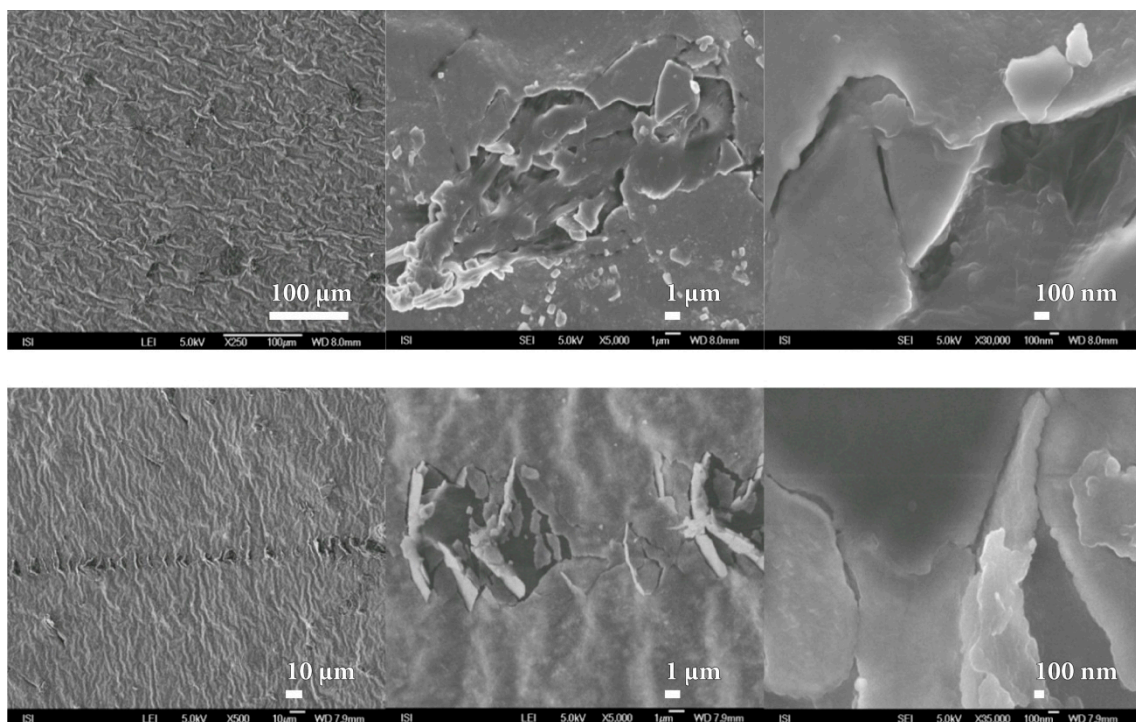
1-the vapor flow regulator of the monomer (used in the case of PECVD), 2-regulator of oxygen flow, 3-argon flow regulator, 4-flange with attached accessories (Pirani gauge, Pennig gauge, needle metering/venting valve), 5-Flange for oil rotary vacuum pump connection, 6- flange for connecting a large oil rotary pump - the first stage of the pumping system, 7-vacuum electrical current feedthrough, 8-turbo molecular vacuum pump, 9-wolfram or molybdenum boat for the evaporation of solid material, 10-stainless steel live powered electrode, 11- stainless steel rotating electrode, 12- reactor inlet, 13-quarz crystal measurement sensor of film thickness , 14-valve, 15-low vacuum small oil rotary pump, 16- main vacuum pump, 17-controlgate valve, 18-gas feedthrough.



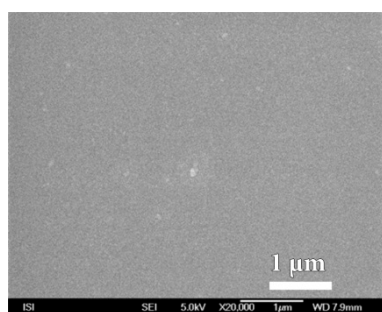
**Figure S3.** Diagram and real appearance of the SorpTest device for testing the resistance of barrier materials against the permeation of gaseous and liquid toxic substances



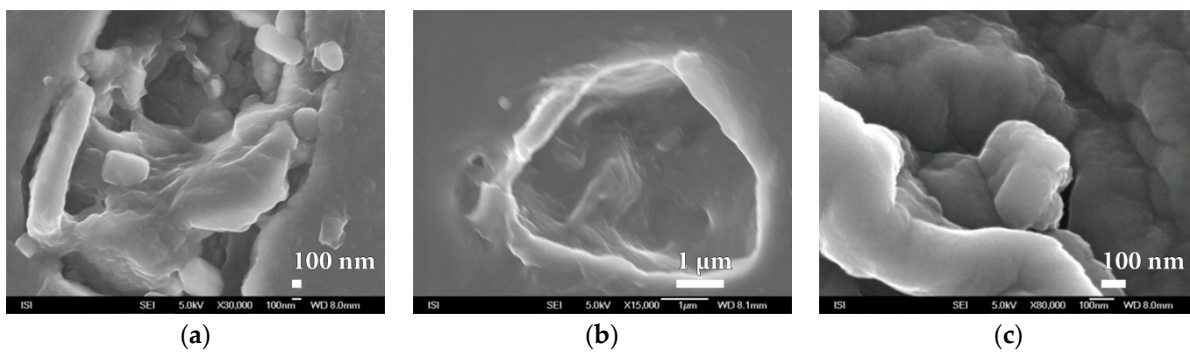
**Figure S4.** Scanning electron microscopy (SEM) micrographs of examples of visual changes of the  $\text{SiO}_x$  barrier layer caused by polymer matrix swelling with visible different kinds of cracks



**Figure S5.** Scanning electron microscopy (SEM) micrographs of examples of visual changes of the  $\text{SiO}_x$  barrier layer caused by mechanical damage.

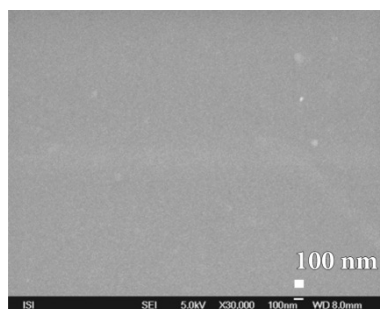


**Figure S6.** Scanning electron microscopy (SEM) micrographs of the surface of the nanolayer of  $\text{SiO}_x$  prepared by HMDSO method on the silicon substrate at various magnifications of 20,000 $\times$  before exposure to DCH

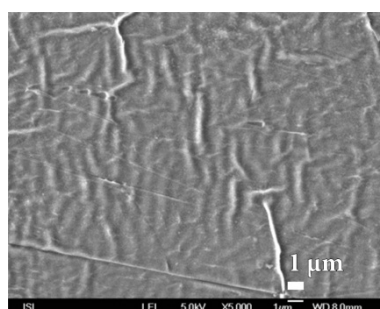


**Figure S7.** The exhibitions of different inhomogeneity on the surface of the used polymer foil PEVA at various magnification of (a) 30,000 $\times$ , (b) 15,000 $\times$ , (c) 80,000 $\times$ .

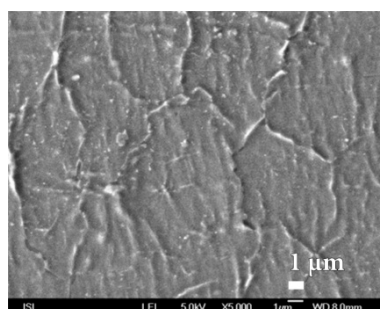




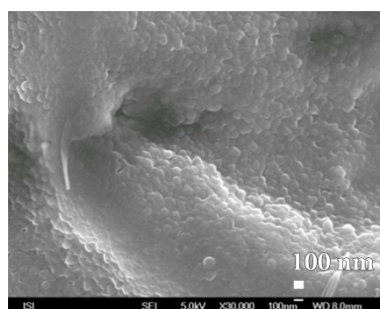
**Figure S8.** SEM micrographs of PVDC foil surface laminated at 110 °C to PEVA foil at magnification of 30,000×.



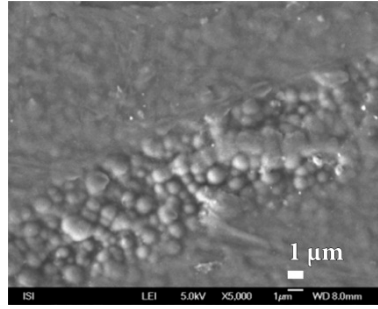
**Figure S9.** SEM micrographs of PVDC foil surface laminated to PEVA foil after short exposure to oxygen plasma treatment at magnification of 5000×.



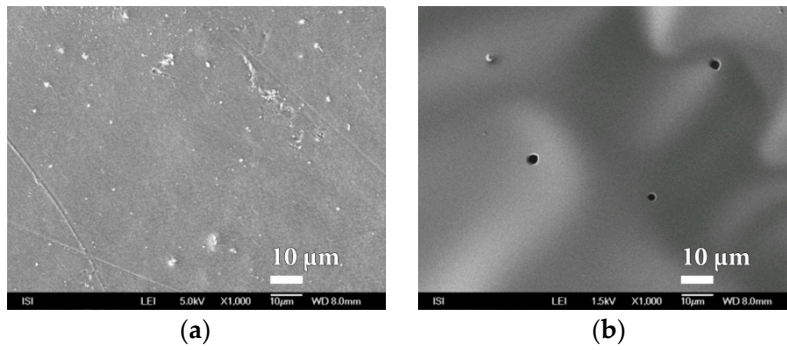
**Figure S10.** SEM micrographs of the surface SiO<sub>x</sub> barrier nanocoating prepared by plasma deposition with the PVD method on PVDC foil laminated on the PEVA foil, at magnification of 5000×.



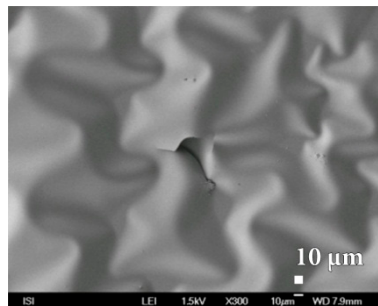
**Figure S11.** SEM micrographs of melamine nanocoating surface on PEVA SiO<sub>x</sub> foil prepared by PVD plasma deposition method at magnification of 30,000×.



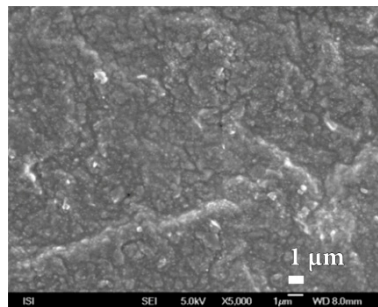
**Figure S12.** SEM micrographs of parylene nanocoating surface on PEVA SiO<sub>x</sub> foil prepared by PVD plasma deposition method at magnification of 5000×.



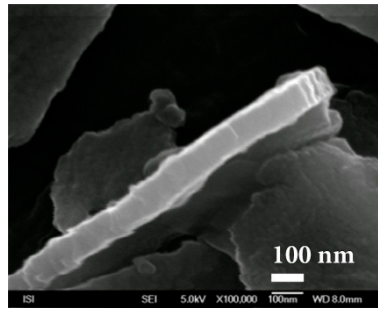
**Figure 13.** SEM micrographs of SiO<sub>x</sub> barrier nanocoating surface prepared by the plasma deposition by HMDSO method on PEVA foil at magnification of (a) 1000× and on PEVA foil stained with aluminum at magnification (b) 1000×.



**Figure S14.** SEM micrographs of surface SiO<sub>x</sub> barrier nanocoating prepared by plasma deposition by HMDSO on the silicon wafer at magnification of 300×.



**Figure S15.** SEM micrographs of surface SiO<sub>x</sub> barrier nanocoating prepared by plasma deposition by HMDSO method on the Viton fluorelastomer at magnification of 5000×.



**Figure S16.** SEM photographs of SiO<sub>x</sub> barrier nanocoating fracture prepared by plasma deposition by HMDSO method on PEVA foil at magnification of 100,000×.