Herein we introduce a novel porous one-dimensional photonic crystal with strong reflectance in the ultraviolet (UV) region of the electromagnetic spectrum. These periodic nanostructures are built by spin-coating assisted layer by layer deposition of colloidal suspensions of non UV absorbing nanoparticles of ZrO$_2$ and SiO$_2$ (electronic band gap at $\lambda<220$ nm). The UV shielding effect takes place totally from optical interference phenomena and is related with the number of deposited layers and the difference of the refractive index values of the two materials that form the unit cell. Interference filters are designed consequently to block specific wavelength ranges in UVA, UVB and UVC regions of the electromagnetic spectrum. In addition, we show that the accessible pore network of the as-deposited multilayer allows preparing flexible, self-standing, selective UV filters without losing considerably reflectance intensity, i.e., preserving the dielectric contrast. We prove that these films outperform layers of similar thickness made of only absorbing materials in terms of the degree of radiation protection achieved.

References