

## Microstructure and nanoscopic porosity in black Pd films

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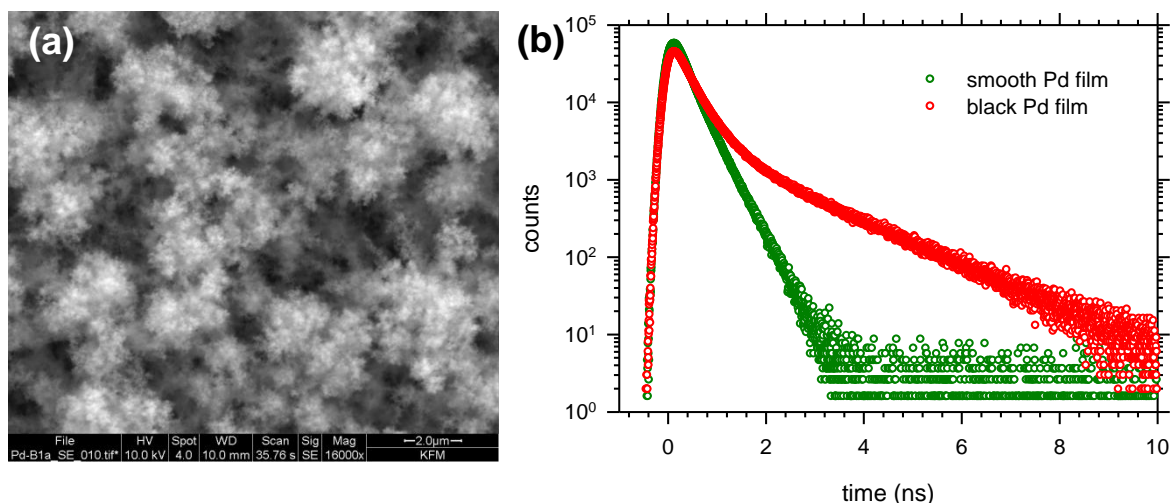
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Thermal evaporation of metals in carefully adjusted low pressure ( $\sim 100$  Pa) of  $N_2$  gas enables deposition of peculiar porous structures known as black metals. Surface of black metals appears dark since light incident on the surface is completely absorbed in multiple reflections in fractal-like structure of percolated micro-cavities with a broad size distribution. Black metals can be used in electronic devices for optical sensing, camouflage and gas sensors. The physical mechanism leading to formation of black metals is not completely understood yet and parameters for their preparation were found empirically.

In the present work microstructure of black Pd films deposited on Si single crystal and glass substrates was studied. Black Pd films were compared with smooth films. Typical microstructure of black Pd film is shown in Fig. 1a. Positron lifetime spectra of black and smooth Pd film are compared in Fig. 1b. Positron lifetime spectrum of black Pd film contains a long-lived component originating from pick-off annihilation of o-Ps. In conventional metals Ps does not form because any bound state of positron and electron is quickly destroyed by the screening of conduction electrons. However, in porous metals containing micro-cavities a thermalized positron may pick an electron on inner surface and escape into a cavity forming Ps.



**Figure 1** (a) Microstructure of black Pd film deposited on Si substrate, (b) comparison of positron lifetime spectra for smooth and black Pd film measured at positron energy of 8 keV.

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