Diamond-like Carbon for Ultra-cold Neutrons

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As a part of the ultra-cold neutron (UCN) source project at the Paul Scherrer
Institut (PSI), the performance of diamond-like Carbon (DLC) as a novel
material for the storage of UCN was investigated and promising results were
obtained. We focus on three important parameters for UCN storage: (i) the
Fermi potential $V_F$, (ii) the loss coefficient per wall collision $\eta$, and (iii) the
spin flip probability per wall collision $\beta$. Contrary to the commonly used ma-
terial Beryllium, DLC is not toxic and widely used in industry. It combines
a low nuclear absorption cross section and a high density, which causes a low
loss coefficient, low inelastic scattering and a large Fermi potential. Systematic
investigations of different DLC coatings by various surface analysis methods we
performed, as well as studies using UCN. We measured values for the loss co-
efficient of DLC $\eta = (7 \pm 0.9) \cdot 10^{-5}$ at 70 K and a depolarization probability
$\beta = (7.5 \pm 2) \cdot 10^{-7}$ which is competitive to Beryllium. Using this experience,
a new facility to produce high density DLC coatings is currently being built at
PSI.