# Nitridated $B_4C$/La multilayer optics for 6.7nm

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Application of $B_4C$/La multilayer optics for $\lambda = 6.7$ nm at near normal (1.5°) incidence in X-FELs[1], next generation lithography, soft x-ray spectroscopy, fluorescence analysis and imaging requires improvement of the reflectance and bandwidth. The $B_4C$/La interfaces suffer from intermixing and interlayer formation. By investigating the kinetic and optical properties of related compounds, we found that they can be passivated by nitridation, simultaneously increasing the optical contrast[2,3]. We observed that $B_4C$ is more readily nitridated by $N_2^+$ bombardment during or after growth than La, which apparently yields an equilibrium that involves dinitrogen complexes[4]. The loosely bound N or $N_2$ in the La/$B_4C$ interface substrate partially diffuses into the adlayer, resulting in surfactant mediated growth[5,6,7,8]. Subsequent nitridation of the adlayer is observed, yielding nitridated interfaces of improved optical contrast that are also chemically inactive to $LaB_6$ and $LaC_2$ interlayer formation[9]. In effect, we enhanced the reflectivity and bandwidth in experimental multilayer optics by up to a factor of 1.3. Calculations show that even further bandwidth improvement can be achieved by replacing $B_4C$ with B and La with Th or U[10].

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