

# Multifunctional graphene coatings with enhanced abrasion resistance, fire-retardant and antibacterial properties

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Surface coatings to protect structural materials from adverse environment such as corrosion, mechanical abrasion, biofouling, and fire-hazards involves multibillion dollar market applied in residential, industrial, and defence industry.[1-2] Previously used protective coatings in these applications based on heavy metals, halogenated fire-retardants and biocides have caused increased concerns both for the health of individuals and for the environments.[2-4] In this paper, we present engineering of new graphene coating providing multifunctional protective properties as an alternative to hazardous constituents. These multiple functionalities were created by specially designed graphene composite with sodium metaborate ( $\text{NaBO}_2 \cdot x\text{H}_2\text{O}$ ) nanocrystals which are working synergistically as a surface binder, a flame retardant additive and an antibacterial agent. The coating revealed an outstanding mechanical robustness (ASTM-class 4B) and the reduction of bacterial colonization up to ~99.92 %. The flame retardant performance of the coating enabled wood and paper to be non-flammable by exhibiting intumescent effect, self-extinguishing ability and structural integrity during fire. The coating with industrial scalability exhibited outstanding performance that offers a great potential for their industrial, structural, and environmental applications.

## References

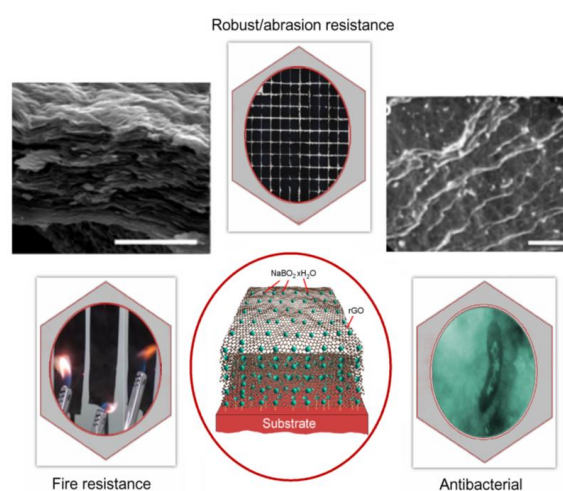
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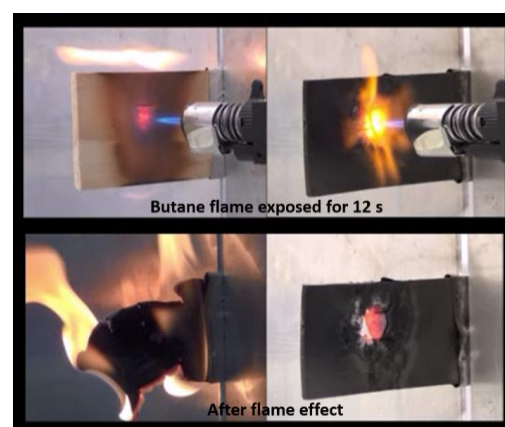
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## Figures



**Figure 1:** Morphological structure of coating and their abrasion resistance, fire retardant and antibacterial application.



**Figure 2:** Flame retardancy effect of superficially coated wood slat. Control wood slat (Left), coated wood slat (right).