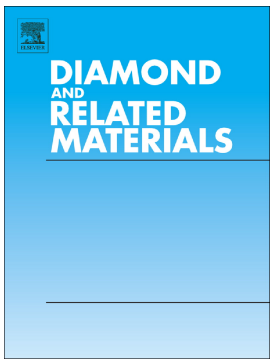

Graphene quantum dots prepared by gaseous detonation toward excellent friction-reducing and antiwear additives

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Graphene quantum dots prepared by gaseous detonation toward excellent friction-reducing and antiwear additives

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Abstract A great deal of research has been focused on the photoluminescence (PL) behaviors of graphene quantum dots (GQDs), but tribological characteristics against GQDs still remain an open issue. Herein, four kinds of powdery GQDs are successfully synthesized via a one-pot gaseous detonation method without any post-treatment or purification. The tribological properties of GQDs serving as lubricant additives for 150SN mineral oil are investigated in detail using a four-ball tester by altering the concentration and types of GQDs. The results demonstrate that GQDs can act as excellent performance additives. In particular, the mean friction coefficient, wear scar diameter and depth of lower balls lubricated by 150SN mineral oil under 392 N correspondingly reduce by 65.2%, 43.5% and 90.9%, when appropriate types of GQDs at optimal additive concentration of 0.8 wt% are introduced. Finally, on the basis of microstructures, compositions and tribological properties of four kinds of GQDs, a reasonable lubricating mechanism of GQDs-based additives is proposed and illustrated that excellent friction-reducing and antiwear properties may be attributed to the synergetic effects, including polishing effect and mending effect.

Key words: Graphene quantum dots; tribological properties; lubricating mechanism; gaseous detonation; photoluminescence behaviors.

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