Knowledge Transfer Office
香港城市大學
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In-situ Synthesis of Isolated Carbon Particles Particles Embedded Diamond-like Carbon Coatings by Magnetron Sputtering

Energy & Environment

Nanotechnology and New Materials

Opportunity

The global market for diamond and diamond-like coatings has increased from $0.8 billion to $1.7 billion from 2009 to 2016. The forecasted growth rate for overall paint and coatings industry is 4.4% for next 5 years, whereas, due to attractive features of DLC coatings the annual growth rate of 14.1% is forecasted for next 5 years (BCC Research LLC. USA). Hence the subjected invention has vital opportunities to replace conventional DLC coatings with carbon particles embedded DLC coatings due to its exceptional outcomes. The invention has broad openings for the MEMS devices to heavy products manufacturer such as automobiles industries. The invented coating architecture will enhance the coating life of bearings, piston cylinder and rings, valves and tappet rods and it will also reduce CO2 carbon emission by improving fuel efficiency.

Technology

The invention exhibits a development of a systematic method for in-situ synthesis of isolated carbon particles simultaneous to diamond-like carbon (DLC) coating deposition through unbalanced magnetron sputtering technique. The invention offers an in-situ synthesis of controlled size (application dependent) isolated carbon particles in the range of 100±20nm, 250nm to 350nm and ~700nm. Meanwhile, the isolation distance can be controlled as less than 1μm, less than 5μm, in between 5μm to I0μm and more than 20μm. The invention also reveals the formation of ~2μm random shape agglomerations having isolation distance of more than 20μm and made of less than ~100nm carbon particles and lastly a method to form 150±50nm sized granular DLC.

Isolated carbon particles embedded DLC coatings also proved beneficial to reduce wear coefficient which decreased with increase in particle density per unit volume. It could also enhance the DLC coating life being used in automotive and machine tool industry. The novel in-situ isolated particle synthesis method could be adopted as a good alternative to produce efficient and durable plasmonic sensors. The subjected approach could be beneficial to develop long life, depth controlled anti-bacterial particle embedded coatings as well.

IP Status
Patent granted

Technology Readiness Level (TRL) ? 5

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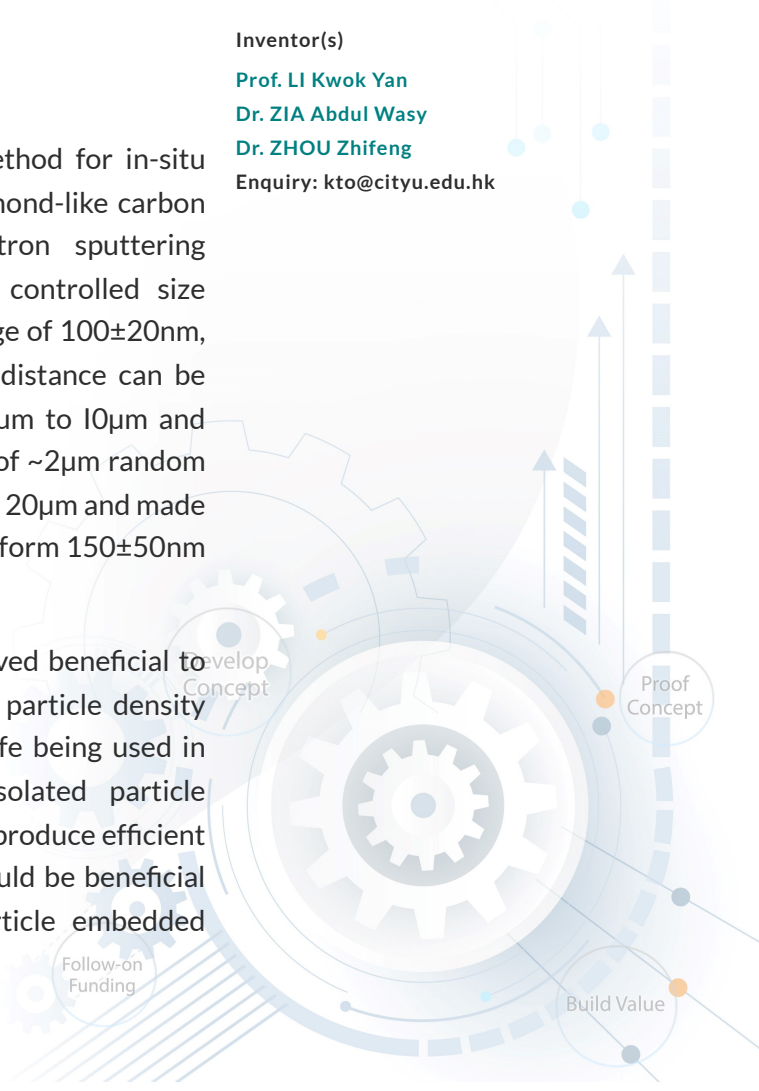

Advantages

- Increase hardness up to a maximum of 34% and fracture toughness up to 21%.
- Reduce wear coefficient and wear rate.
- Reduce the limitations for wet lubricated and dry/self lubricant coatings required in microelectromechanical (MEMS) devices.
- Provides a reliable and long lasting wear resistance solution.

Applications

- Diamond-like carbon (DLC) coating deposition.
- Low-cost plasmonic sensors.
- Particles (anti-bacterial, medicine) embedded anti-bacterial coatings.