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# Rapid Microwave Irradiation Synthesis of Carbon Nanotubes on Graphite Surface and Its Application on Asphalt Reinforcement

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## Abstract:

Due to its superior mechanical properties, carbon nanotubes (CNTs) can be applied for material reinforcement and modification. However, the relatively high cost for CNTs synthesis limits their large application in construction materials. This study employed the microwave irradiation method to produce CNTs with low cost and high efficiency. The ferrocene powder was mixed with graphite surfaces and irradiated with the microwave. Particularly, the flake graphite and exfoliated graphite nanoplatelets (xGNP) were applied in this study as substrate. The high temperature generated by the microwave irradiation can decompose ferrocene into iron and hydrocarbons, which serve as the catalyst and carbon source for the CNTs growth, respectively. The morphology, internal structure and chemical composition of the synthesized CNTs were then examined with SEM, TEM and EDS. The Raman test was also conducted to investigate the defect level of synthesized CNTs. Then the adhesion energy between the CNTs and substrate was evaluated with the MD simulation. The obtained adhesion energy between CNTs and non-oxidized graphene layers was slightly higher than the calculated results between CNTs and oxidized graphene layers. Finally, the hybrid CNTs-graphite powders were used for the modification of asphalt binder. The test results of viscosity and dynamic shear modulus tests

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