

13<sup>TH</sup> INTERNATIONAL CONFERENCE ON

## ADVANCED MATERIALS AND NANOTECHNOLOGY

OCTOBER 26-28, 2017 OSAKA, JAPAN

**3D printing graphene oxide geopolymer nanocomposites and its structural failure model****Jing Zhong**

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Preparation of inks with proper viscoelasticity is the key pre-requirement for extrusion based 3D printing. Here, extrusion based 3D printing Graphene Oxide (GO)/Geopolymer (GOGP) nanocomposite was reported for the first time. We found that, the addition of GO in geopolymeric aqueous mixture (alumio-silicate and alkaline-source particles) dramatically changes its rheology properties and enable the 3D printing that cannot be realized solely by geopolymer, indicating a strong GO/alumio-silicate interaction. We proposed a model, in which a water layer is laminated between GO and alumio-silicate, based on the facts that both of GO and alumio-silicate are hydrophilic and negatively charged, to account for such phenomenon. The chemical and microstructure analysis showed that the GO nanosheets anchor themselves around and encapsulate individual geo-polymer grains to resist being pullout and at the same time, form a continuous 3D network throughout the whole nanocomposites, which was proved by selective etching of geo-polymer and left behind free-standing porous GO aerogel. Therefore, not only the mechanical properties of geo-polymer were significantly increased by GO, but also very high electrical conductivity was obtained after sintering and endow our 3D printing nanocomposite among the highest conductive ceramic nanocomposites. In addition, we found that, enhancing mechanical properties at material level by employing large GO nanosheets, will inevitably switch failure model from stretching/compression to buckling instability, thus limit the fully exploitation of material properties and thus in turn, structural performance. This finding suggests the local modification of 3D printed structures, especially weakening the rotational stiffness of nodes, is critical for the realization of 3D printing super-strong cellular solid.

**Biography**

Jing Zhong has completed his PhD from Harbin Institute of Technology, China. He is the Group Leader of 3D printing in the Institute of Advanced Ceramic HIT. He has published more than 20 papers in reputed journals.

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