Processing and Properties of Ceramic Geopolymer Based Materials

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Keywords: Geopolymer, Ceramics, UHMWPE, Strength

Geopolymer is an inorganic polymeric material synthesized from the dissolution and polycondensation of aluminosilicates in alkaline solutions at ambient temperature yielding an amorphous, three-dimensional polymeric framework. Geopolymer technology has been involved in many applications including in the formation of ceramic. The transformation phase of geopolymer from amorphous to crystalline upon sintering require a low processing temperature compared to the conventional ceramics. A major synthetic process for industrialised lightweight ceramics is to use additives which are organic in nature such as binders, plasticizers, surfactants and lubricants. This study investigated the use of geopolymer in producing ceramic materials where kaolin was used as main source material and Ultra High Molecular Weight Polyethylene was added as binder. The outcomes revealed the possibility to produce a ceramic based kaolin-geopolymer with a considerable characteristics and mechanical properties, which could open the door for many applications in the future. Results showed that sodium hydroxide molarity of 12 M, alkaline activator ratio of 0.24 and sintering temperature of 1200 °C gives the highest flexural strength of 88.47 MPa and a density of 2.13 g/cm^3.While the addition of 4 wt.% of Ultra High Molecular Weight Polyethylene sintered at 1200 °C could achieve an optimum strength of 94.32 MPa with a density of 1.71 g/cm^3. Geopolymer based ceramic has been claimed as a promising material, due to its ability to produce a high-performance lightweight ceramic and because of its relevant environmental and economic benefits. Furthermore, lower-powered mechanical and thermal treatments are required to ensure the excellent properties and quality to produce the lightweight ceramic materials lead to a positive effect on the environment hence suitable with the desire for eco-friendly industry.