

## Geopolymer Concrete: A Review of Properties, Applications and Limitations

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**Abstract :** The concept of a safe environment and low greenhouse gas emissions is a common concern especially in the construction industry. The produced carbon dioxide (CO<sub>2</sub>) emissions are nearly a ton in producing only one ton of Portland cement, which is the primary ingredient of concrete. Current studies had investigated the utilization of several waste materials in producing a cement free concrete. The geopolymer concrete is a green material that results from the reaction of aluminosilicate material with an alkaline liquid. A summary of several recent researches in geopolymer concrete will be presented in this manuscript. In addition, the offered presented review considers the use of several waste materials including fly ash, granulated blast furnace slag, cement kiln dust, kaolin, metakaolin, and limestone powder as binding materials in making geopolymer concrete. Moreover, the mechanical, chemical and thermal properties of geopolymer concrete will be reviewed. In addition, the geopolymer concrete applications and limitations will be discussed as well. The results showed a high early compressive strength gain in geopolymer concrete when dry- heating or steam curing was performed. Also, it was stated that the outstanding acidic resistance of the geopolymer concrete made it possible to be used where the ordinary Portland cement concrete was doubtful. Thus, the commercial geopolymer concrete pipes were favored for sewer system in case of high acidic conditions. Furthermore, it was reported that the geopolymer concrete could stand up to 1200 °C in fire without losing its strength integrity whereas the Portland cement concrete was losing its function upon heating to some 100s °C only. However, the geopolymer concrete still considered as an emerging field and occupied mainly by the precast industries.

**Keywords :** geopolymer concrete, Portland cement concrete, alkaline liquid, compressive strength

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