Devoloping High Wear Resistant Porcelain Tile Glass-ceramic Glazes Under Industrial Fast Firing Condition

Ayşe Tunalı[1], Güneş Çiğdemir Korç[2], Yeşim Baltacı[1], Alpagut Kara[2,3]

[1]Eczacıbaşı Building Product Co. VitrA Innovation Centre, Bilecik/Turkey
[2]Ceramic Research Center, Anadolu Univercity, Yunusemre Campus ETGB Anadolu Teknoparkı, Eskişehir/Turkey
[3] Anadolu University, Department of Material Science and Engineering, İki Eylül Campus, 26480/Eskişehir/Turkey

The aim of this study was to develop glass ceramic glazes with high abrasion resistance for floor and porcelain tile applications. Glazes in the ZnO-CaO-Al_2O_3-SiO_2 system with crystallization ability of gahnite and anorthite were synthesized. The first of all, anorthite base glass ceramic glazes were synthesized successfully under the industrial fast firing conditions. Then, the further compositions were designed in a way that the molor ratio of SiO2/Al2O3 was kept constant and CaO/ZnO ratio was decreased. By this approach, co-precipitation of anorthite and gahnite was observed with the small addition of zinc oxide The microhardness and the wear performance of the studied glazes increased with increasing gahnite crystals in the anorthite based glass ceramic system.

Synthesized glazes were applied on to the pre-engobed commercial porcelain tiles and fired at 1215^{o}C in a industrial roller furnace for 38 minutes (cold to cold). The crystalline phases were determined by X-ray diffraction (XRD). The crystallization kinetics were determined by differential thermal analysis (DTA). Scanning electron microscope (SEM) in combination with an energy dispersive (EDX) spectrometer was further employed to investigate microstructural and microchemical features of the fired glazes. The abrasion resistance was determined according to the EN-ISO 1545-7 standard (PEI method). EN ISO 10545 standards were employed to the industrially produced glazed ceramic tiles and the assessment was made according to the EN ISO 14411 standard.

Key words : Glass ceramics, Anorthite, Gahnite, Crystallization, Microsturucture

e-mail : gcigdemir@anadolu.edu.tr