

IS CLAY ESSENTIAL FOR THE MANUFACTURING OF CONSTRUCTION CERAMICS?

GOMES, C. S. F.

Centro de Investigação Minerais Industriais e Argilas, Universidade de Aveiro, Campus Universitário de Santiago, Aveiro, 3810 193, Portugal
E-mail: cgomes@geo.ua.pt

Clays are currently used in the manufacture of construction ceramics and other types of ceramics, essentially due to their plasticity, a property that is specific of clay minerals. Plasticity is developed through the clay minerals–water interaction and it allows the workability of the ceramic pastes, which is fundamental for the wet shaping of the ceramic products. However, the fabrication of any clay-based ceramic products is not possible if the clay exclusively consists of clay minerals. In such conditions the body shape is disrupted during drying and firing due to uncontrolled body retraction related to the excessive loss of both free and hygroscopic water. Quartz, mica, feldspar, other silicates and sometimes calcite, existing in the natural clay or added to the clay, can provide the adequate temper of the mixtures.

Slip casting, extrusion and pressing are the most currently used types of ceramic processing. The last two processes can be used in the manufacture of construction ceramics. Extrusion requires a blend of raw materials in the form of paste, what means that for the shaping of the ceramic bodies at least one of the raw materials has to show adequate plasticity.

On the other hand, pressing requires raw materials in the form of almost dry powder, plasticity being not a relevant property for shaping the ceramic bodies, and using high pressure presses of these days, ceramic bodies characterised by high intergranular cohesion can be produced.

Clays—as most of the geologic products—are not renewable resources, and in many regions the currently mined clay

deposits are close to the exhaustion. This problem is aggravated since the exploitation of some other potential deposits is not possible due to legal, environmental or territorial planning constraints.

Other geologic materials, such as, phyllites and low grade metamorphic schists of pelitic composition, also have to be considered as ceramic raw materials as replacements of clay deposits. Like in the clay deposits, different silicates, particularly phyllosilicates, are the main components of these geomaterials. The difference concerns the coarse-grain size and the higher mica and chlorite content exhibited by both phyllites and low grade metamorphic schists, as well as the higher density or compaction exhibited by these rocks. Even when finely ground these materials perform very low plasticity. On the other hand the ceramic products manufactured with them are characterised for the low retraction they exhibit during drying and firing.

Studies on the potential use of phyllites and schists for the manufacture of construction ceramics, particularly floor tiles and massive facing bricks, have been carried out in recent years. Also, fine-grained silty or clayey soils, either residual or redeposited, can be used as raw materials to manufacture construction ceramics. The viability of the production of construction ceramics using mixtures based essentially on low-plastic or non-plastic raw materials, such as residual soils (andosols), lapilli and mud from the processing of aggregates derived from volcanic rocks has been assessed and the results are herewith disclosed and discussed.