THE SOL-GEL TRANSITION: A NATURAL CHEMICAL MECHANISM AFFECTING STATIC AND DYNAMIC BEHAVIOUR OF SOILS AND ROCKS.

FORERO-DUEÑAS, C. A. Ingeominas, Diagonal 53 # 34-53, Santafé de Bogotá, Colombia.

Evidence shows that silica-gels can be found naturally in the ground, and they can be expected to influence the geomechanical response, both static and dynamic, of the soils and rocks of which they are part, acting essentially as a cementing agent. A first order model of solid grains coated by boundaries of amorphous silica-gel is presented. The gels were produced in the laboratory, with mixtures of sodium silicate solution, water and hydrochloric acid. Among all the possible classes a gel having a pH of about 7.0, i.e. away from the acidic or alkaline extremes, was selected for testing.

The mechanical testing of wet gels was done in order to picture the sol-gel transition, by measuring continuously the low strains shear modulii, Gmax. Such a mechanism of hardening, joined with the effects of the environment, such as drying, produces a material considered to be capable of become engaged in the geomechanical response of soils and rocks.

The novel concept of the sol-gel transition unveils a chemical strengthening mechanism which is responsible for the rheological change from liquid-like materials, i.e. materials that cannot sustain shear stresses, to semi-solid bodies having infinite viscosity (measured in a Bohlin rheometer) and finite values of shear modulus (measured in a Pulse shearometer). This mechanism of strength gain is found to be originated on the polymerisation of seeds of monosilicic acid, which transform to chains and networks made up siloxane bonds, being such network a silica-gel: the connectors between solid grains in real soils and rocks.