BINDING AND SOLIDIFICATION OF RADIOACTIVE WASTES IN HOT PRESSED CEMENT SYSTEMS

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Blended cement systems, which are characterized by an increased degree of binding of some radioactive wastes, have been developed. Along with ordinary Portland cement (OPC), these systems include other mineral components (blast furnace slag, fly ash and bentonite), which improve the chemical fixation of radionuclides inside solidified compounds. Different cement compositions were utilized for the investigation of the processes of binding and solidifying radioactive wastes while hot pressing (i.e. the simultaneous effect of increased temperature and pressure upon a hardening system).

The influencing parameters of hot pressure (temperature, pressure and time of their duration) on processes of forming the structure of the cement paste have been investigated. Hot pressing with a pressure of 25–50 MPa, temperature of 150–200 °C and duration of 30–45 min have proved to have an influence upon most processes of structure forming. In contrast to samples obtained by traditional cementation, in the composition of hot pressed cements calcium hydroxide, the most easily leached hydrate phase, is not present.

The study of physical and mechanical properties of hot pressed cements including radioactive wastes has shown them to be characterized by decreased porosity (< 10%), increased water resistance, and a decreased level of the leach rate of radionuclides (< 1×10^{-5} g/cm^2×day). In addition, obtained products have an increased compressive strength (30–100 MPa).

It has been proved that hot pressed cements have a several times higher capacity of radioactive wastes with respect to traditional cements, and at the same time exhibit a leach rate of radionuclides several orders lower than those produced by traditional methods. As a result of these researches, the technology and a plant for hot vibro-pressing for the immobilization of radioactive wastes in Chernobyl Exclusion Zone have been designed.