Solubility experiment in subsystems of Sr-Mg-Al- Cl-H_2O at 298 K

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During the past decades, the strontium sector in China developed quite rapidly, thus after more than 20 years of exploitation, most of the high-grade resources had been depleted, and heavy tailings accumulation causes serious environmental pollution and waste of resources. In the technology of extracting strontium from a strontium tailings leaching solution which uses HCl as lixiviant, the main components of the leaching solution can be described with the complex system $SrCl_2$-$CaCl_2$-$MgCl_2$-$AlCl_3$-H_2O. In the system mentioned above, many types of hydrate salts, double salts and solid solution can be formed, and this makes production of purified salt from the solution more difficult to achieve.

In the past few years, phase separation techniques have been extensively used in many industrial processes such as crystallization, precipitation, and extraction of chemical products from liquid minerals. Accordingly, the phase equilibria of three subsystems of Sr^{2+}, Mg^{2+}, Al^{3+} // Cl^- - H_2O at 298 K have been done by using isothermal dissolution method and Schreinemakers wet residues method. Results show that: (1) system Sr^{2+}, Mg^{2+} // Cl^- - H_2O belongs to complex type with three single salts $SrCl_2{\cdot}6H_2O$, $SrCl_2{\cdot}2H_2O$, $MgCl_2{\cdot}6H_2O$ formed; Comparisons between the stable phase diagrams of $SrCl_2$ + $MgCl_2$ + H_2O system at (298 K, 323 K, 348 K, and 373 K) show that the crystallization form of magnesium chloride has not changed with the temperature, while the amount of crystal water of strontium chloride changed from six to one with the temperature increasing. (2) system Sr^{2+}, Al^{3+} // Cl^- - H_2O belongs to simple type with two hydrate salts $SrCl_2{\cdot}6H_2O$, $AlCl_3{\cdot}6H_2O$ formed. (3) there are two hydrate salts $MgCl_2{\cdot}6H_2O$ and $AlCl_3{\cdot}6H_2O$ formed in the system Mg^{2+}, Al^{3+} // Cl^- - H_2O, without double salt or solid solution found.

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