Optimization of thermodynamic properties and phase diagrams of P_2O_5 and CaO-P_2O_5 systems

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P_2O_5 is an important oxide component in the late stage products of igneous rocks such as granites and anorthosites. More often than not, it combines with CaO and crystallizes in the form of apatite, while in volatile-free conditions, Ca-whitlockite is formed. In spite of their interest, the thermodynamic properties and phase diagrams of the P_2O_5 unary and CaO-P_2O_5 binary are not well known yet. In the case of the P_2O_5 unary, no experimental thermodynamic data are available for the liquid and the *O* and *O'* solid phases. As a result, we re-evaluated all the thermodynamic and phase diagram data of pure P_2O_5. The CaO-P_2O_5 binary was then optimized to reproduce all available thermodynamic and phase equilibrium data simultaneously in order to obtain one set of model equations for the Gibbs energies of all phases as functions of temperature and composition. Thermodynamic modeling was performed using the Modified Quasichemical Model [1-3] implemented in the FactSage software [4]. The optimized CaO-P_2O_5 binary is shown in Figure 1.

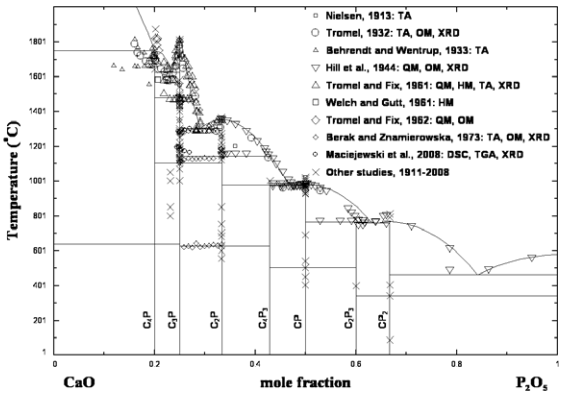

Figure 1: Optimized CaO-P_2O_5 binary.

[1] Pelton & Blander (1984) *Proc. AIME Symp. Metall. Slags Fluxes*, TMS-AIME, 281-294. [2] Pelton & Blander (1986) *Metall. Trans. B* **17** 805-815. [3] Pelton *et al.* (2000) *Metall. Mater. Trans. B* **31**, 651-660. [4] Bale *et al.* (2002) *Calphad* **26**, 189-228.

Penetration, accumulation and degradation of Deepwater Horizon oil in Florida sandy beaches

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Crude oil from the Deepwater Horizon spill was washed onto sandy shores of the Northern Gulf of Mexico, and this study investigates the fate of this oil and its impact on microbial communities in oiled beach sands. Tar balls and pancake oil were deposited on the beach surface, and due to the subsequent deposition of sand layers, congealed oil and tar were embedded as deep as 75 cm in Pensacola beach sands. Dissolved, low-viscosity and dispersed oil fractions could penetrate the sand through the pore space, staining the beach surface layers. Adsorbed oil increased the cohesiveness of the sand and reduced sand permeability. Oiled sand layers contained elevated rates of potential oxygen consumption and dissolved inorganic carbon production, indicative of ongoing degradation of the sedimentary oil deposits. Twenty-four bacterial strains from 14 genera were isolated from oiled beach sands and confirmed as oil-degrading microorganisms by phenotypic characterization and phylogenetic analysis of small subunit (SSU) ribosomal RNA (rRNA) gene sequences. SSU rRNA gene copy numbers of total bacteria were approximately 10 times higher in oiled vs. clean sand. Oil contamination from the Deepwater Horizon spill had a profound impact on the abundance and community composition of indigenous bacteria in Gulf beach sands, and our evidence points to members of the *Gammaproteobacteria* (*Alcanivorax*, *Marinobacter*) and *Alphaproteobacteria* (*Rhodobacteraceae*) as key players in beach oil degradation.