

THE METAL RICH-PART OF THE PHASE SYSTEM Cu-Fe-Pd-S AT 1000°, 900° AND 725°C

KARUP-MØLLER, S. and MAKOVICKY, E. Department of Geology and Geotechnical Engineering, Technical University of Denmark; Geological Institute, University of Copenhagen, Denmark.

At 1000°C, the dry Cu-Fe-Pd-S system contains bornite ss, Cu-Pd-Fe alloys with a broad immiscibility region close to the Cu-Fe join and sulphide melt. Immiscibility of two sulphide melts was observed in three-phase associations liquid-1 ($\text{Pd}_{6.9}\text{Cu}_{63.8}\text{S}_{29.3}$) – liquid-2 ($\text{Pd}_{28.6}\text{Cu}_{51.8}\text{S}_{19.6}$) – alloy ($\text{Pd}_{36.1}\text{Cu}_{63.9}$) and liquid-1 ($\text{Pd}_{9.1}\text{Cu}_{55.4}\text{Fe}_{3.6}\text{S}_{31.9}$) – liquid-2 ($\text{Pd}_{30.2}\text{Cu}_{45.2}\text{Fe}_{3.9}\text{S}_{20.7}$) – alloy ($\text{Pd}_{42.1}\text{Cu}_{52.1}\text{Fe}_{5.8}$). Bornite reaches to 22.2 at.% Fe. For low Pd contents, the alloy is slightly enriched in Pd against melt, for high Pd contents the distribution is equalized or reversed.

At 900°C the system contains bornite ss, iss, mss, a broad field of alloys and melt. Prominent associations are bornite (up to 1.2 at. % Pd) – alloy (from 41.0 to 48.5 at. % Pd) – melt (32.2 to below 20.9 at. % Pd, both with increasing Fe contents) as well as mss (up to 1.3 at. % Cu, and nearly Pd free) – alloy (up to 28 at. % Pd) – melt (up to 0.5 at. % Pd) evolving into alloy (62 at. % Pd) – melt (18 at.% Pd) – mss (0.07 at. % Pd and 0.9 at. % Cu). Melt is confined to moderate and high Pd contents except for the compositions with Fe:Cu ratios of about 60:40, where it descends to Pd free areas. The melt-free association extends to about 30 at. % Pd in the alloy.

At 725°C the melt field recedes considerably, especially on the Fe-rich side, the miscibility gap in Fe rich alloys widens and Pd_4S appears. The association bornite (to 1.8 at.% Pd) – mss (traces of Pd) – alloy stretches from about 33.3 to 65.6 at.% Pd in the alloy, at which point melt (~33.5 at.% Pd) appears. The Cu-rich associations with alloys with <44-50 at.% Pd are melt-free.