The high-temperature heat capacity of fayalite was reinvestigated using drop and differential scanning calorimetry. The resulting data together with drop calorimetry data taken from the literature were analyzed yielding $C_p J/(mol \cdot K) = -584.388 + 129440 \cdot T^{-1} - 3.84956 \cdot 10^7 \cdot T^{-2} + 4.10143 \cdot 10^9 \cdot T^{-3} + 98.4368 \cdot \ln(T)$. This new $C_p$ polynomial is recommended for calculating phase equilibria involving fayalite at mantle conditions. Using thermal expansion coefficient and isothermal bulk modulus data from the literature, the isochoric heat capacity was calculated resulting in $C_V J/(mol-K) = -217.137 + 63023.1 \cdot T^{-1} - 2.15863 \cdot 10^7 \cdot T^{-2} + 2.23513 \cdot 10^9 \cdot T^{-3} + 51.7620 \cdot \ln(T)$.

**Keywords:** Specific heat, ferrous orthosilicate, high temperature, heat content

**Experimental methods**

**Synthesis and characterization**

Fayalite was synthesized following the method of von Seckendorff and O’Neill (1993). Highly pure Fe$_2$O$_3$ and SiO$_2$ powders were thoroughly mixed under acetone in an agate mortar and pressed to pellets. The pellets were arranged in a pile, put into a Pt crucible and heated in a CO/CO$_2$ gas flow furnace for 24 h at 1408 K. The oxygen fugacity was chosen according to the Fe/FeO buffer at log($f_{O_2}$) = -12.77. After 24 h the temperature was lowered to 1108 K and the sample quenched from that temperature by dropping into dry ice. To ensure that the sample remained in the stability field of fayalite during cooling from 1408 to 1108 K, the oxygen fugacity was raised to log($f_{O_2}$) = -12.10 before cooling. Because Pt incorporates Fe at high temperatures, the lowermost pellet in the staple, in contact with the crucible, has been discarded. The pellets were then crushed, homogenized for a second time, and the whole procedure repeated. X-ray powder diffraction (Guinier-Jagodzinski camera, CuKα radiation) did not show a secondary phase. According to Schwab and Küstner (1977), the d(130) value corresponds to a fayalite content of 99.3 mol%. Refinement of the orthorhombic unit-cell parameters from 20 singular peaks resulted in $a = 4.8192(5)$, $b = 10.4785(9)$, $c = 6.0883(10)$ Å, and $V = 307.45(7)$ Å$^3$. 

---

**Figure 1.** The isobaric heat capacity, $C_p$, of fayalite as a function of temperature. O 53 = Orr (1953); HP = Holland and Powell (1998, 2011); W 82 = Watanabe (1982).

---