Mixing Enthalpies of TbBr$_3$-MBr Liquid Mixtures

(M = Li, Na, K, Rb, Cs)

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The molar enthalpies of mixing, $\Delta_{\text{mix}}H_m$ in the binary liquid systems TbBr$_3$-MBr (M = Li, Na, K, Rb, Cs) have been measured with a Calvet-type high-temperature microcalorimeter over the entire composition range with an accuracy of about 6%. Mixing of the two liquid components was achieved by using the “break-off ampoule” technique. All the investigated systems show negative enthalpies of mixing with a minimum value of approximately –1.25, –8.3, –17.0, –20.0 and –22.5 kJ mol$^{-1}$, for M = Li, Na, K, Rb and Cs, respectively. The mixing enthalpy in the TbBr$_3$-LiBr system is positive in the TbBr$_3$-rich region. For all the systems, the enthalpy minimum occurs at mole fraction $x_{\text{TbBr}_3} \approx 0.3$ - 0.4. The molar enthalpies of formation $\Delta_{\text{form}}H_m$ (3MBr, TbBr$_3$, li) for M = Li, Na, K, Rb and Cs at 1113 K (arising from the reaction 3MBr$_l$ + TbBr$_3$$_l$ = (3MBr, TbBr$_3$)$_l$) are found to be –4.8, –31.3, –63.3, –70.3 and –81.2 kJ mol$^{-1}$, respectively. The least-squares coefficients $A$, $B$, $C$, $D$ and $E$ in the equation $\lambda$ (kJ mol$^{-1}$) = $A + Bx + Cx^2 + Dx^3 + Ex^4$, where $\lambda$ is an interaction parameter and $x = x_{\text{TbBr}_3}$, are also reported.

Key words: Terbium Bromide; Alkali Bromides; Mixing Enthalpy; Formation Enthalpy.