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# EVALUATED PHASE DIAGRAMS OF BINARY METAL-TELLURIUM SYSTEMS OF THE D-BLOCK TRANSITION ELEMENTS

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# EVALUATED PHASE DIAGRAMS OF BINARY METAL-TELLURIUM SYSTEMS OF THE D-BLOCK TRANSITION ELEMENTS

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## 13. SYSTEM MO-TE

**Liquid Phase:** No liquid phase in this system upto 1 atm of Te vapor is known.

Terminal Solid Solution: The solid solubility of Te in Mo at 1373 K is less than 1-2 at.% (1). The molybdenum solvus is given by $\ln X_{Te} = 6600/T$ between 700 and 1573 K (2). The solid solubility of Mo in Te must be negligible in view of the low solubility of Mo in liquid Te.

**Intermediate Phases:** There are two intermediate phases $Mo_3Te_4$ (2,3) and $MoTe_2$ (2-12). The ranges of homogeneity of $Mo_3Te_4$ (3,12) and of $MoTe_2$ (3,9,12) have been assessed by (13) as follows. The Mo-rich boundary of the $Mo_3Te_4$ phase ranges from 56.5 at.% Te at low temperatures to 55.9 at.% Te at 1570 K. The Te-rich boundary ranges from 57.4 at.% Te at low temperatures to 58.3 at.% Te at 1450 K.The $Mo_2Te_3$ phase of (4) and (7) probably belongs to the $Mo_3Te_4$ phase.The Mo-rich boundary of $MoTe_2$ is nearly independent of temperature at 65.5 at.% Te. The Te-rich boundary shifts from 65.5 at.% Te at1450 K to 66.6 at.% Te at 1260 K(9,12).$MoTe_2$ undergoes phase transition from hexagonal to monoclinic form, the transition temperature varying from 1153 K at the Mo-rich end to 1093 K at the Te-rich end.

Crystallographic Data: The crystallographic data along with the homogeneity ranges are given in Table 13 A according to the compilation by (13).

Phase Diagram: The phase diagram has been evaluated by (13). The isobaric phase diagram at 1 atm. based on the dissociation pressure data of (14) is given in Fig. 13. (13) surmised in analogy to Mo-S and Mo-Se systems(15), Mo-Te system should show Mo-$Mo_3Te_4$ and $Mo_3Te_4$-$MoTe_2$ eutectics around 1673 K with congruent melting points of 1773 to 1873 K at high pressures.

TABLE 13 A

Crystal Structures of the Intermediate Phases in the System Mo-Te

| Phase designation | Composition range $X_{Te}$ | Structure | Space group | Lattice parameter nm |
|---|---|---|---|---|
| $Mo_3Te_4$ | 0.565-0.574 (low temperature) | hexagonal | $R\bar{3}$ | a=1.013; c=1.170 |
| | 0.559-0.583 (1500 K) | | | |
| | 0.555-0.608 (1273 K) (3) | monoclinic | - | a=0.4875; b=0.5092 c=0.7051; $\beta=93.75^0$ (16) |
| | 0.539-0.593 (933 K) (3) | | | |
| $\alpha$-$MoTe_2$ | 0.655-0.666 (1260 K) (9,11) | hexagonal ($MoS_2$) | $P6_3/mmc$ (hP6) | a=0.35182; c=1.39736 (17) |
| | 0.652-0.667 (933 K) (3) | | | |
| $\beta$-$MoTe_2$ (high temp) | 0.649-0.661 (1273 K) (3) | monoclinic | P2/m (mP12) | a=0.633; b=0.3469 c=1.386; $\beta=93^055'$ |

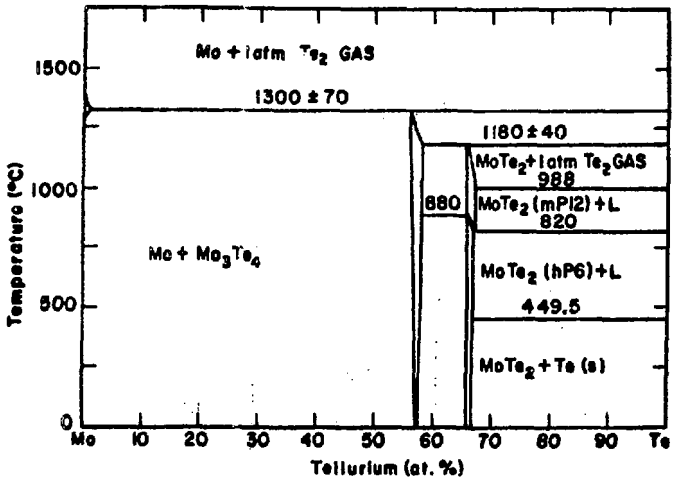


Fig.13. Phase Diagram of the Molybdenum-Tellurium System.

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