Composition optimization of metallic glass through using CALPHAD

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Bulk metallic glass forming composition

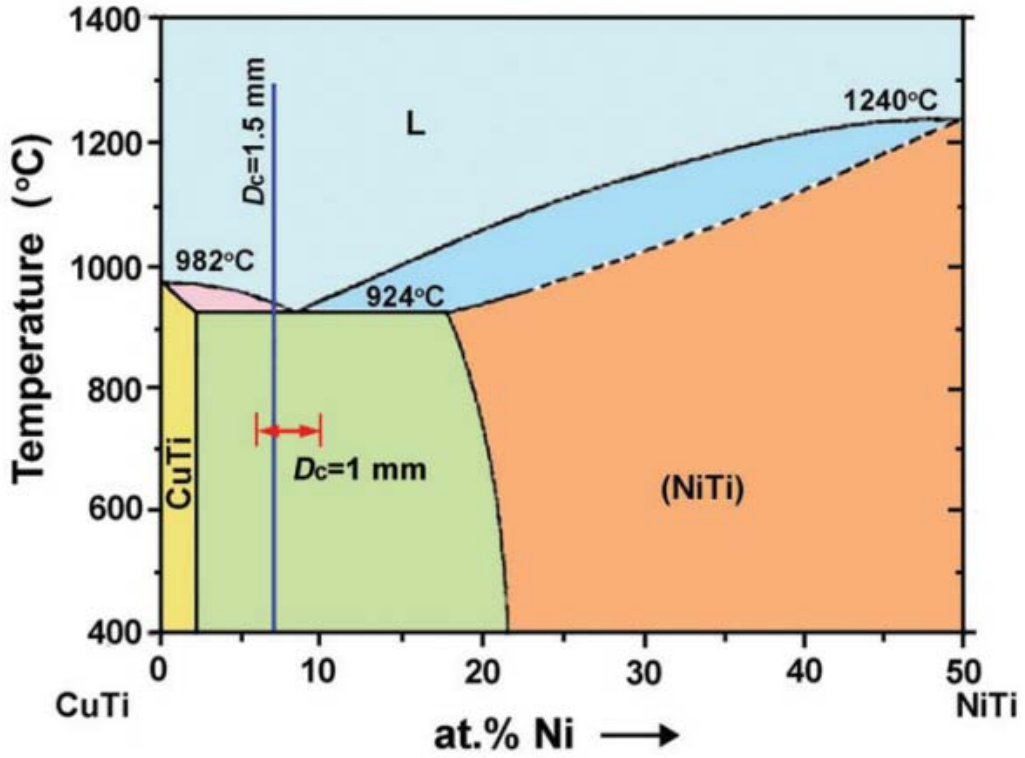


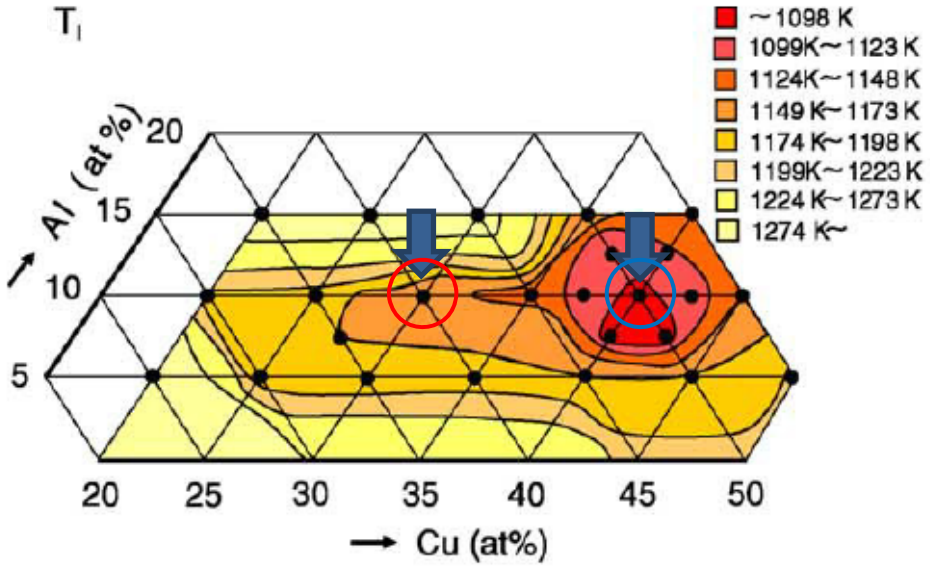
Figure 1. Vertical section of the ternary Ti–Cu–Ni phase diagram [11].
Notes: The composition region of BMG formation with critical diameter $D_c = 1$ mm is marked as a double-ended arrow, $Ti_{50}Cu_{50-x}Ni_x$ $(6 \leq x \leq 10)$. The best glass-forming composition with 1.5 mm diameter is marked by the vertical line.

Eutectic composition → High liquid stability → High glass former

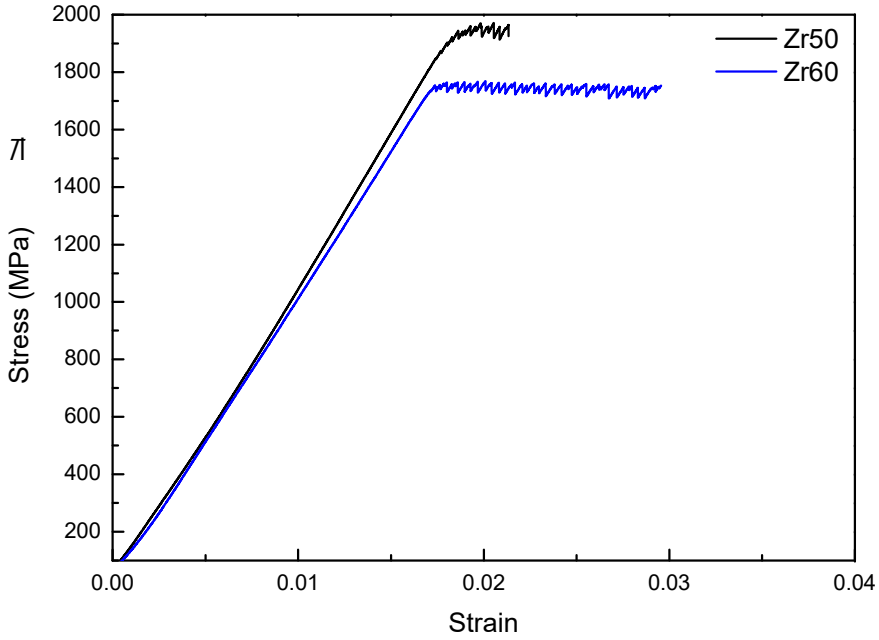
Eutectic vs Hypereutectic

Comparison between
relatively strong glass former and relatively fragile glass former

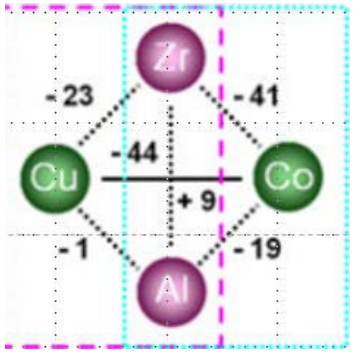
Eutectic ($Zr_{50}Cu_{40}Al_{10}$) Hypereutectic ($Zr_{60}Cu_{30}Al_{10}$)

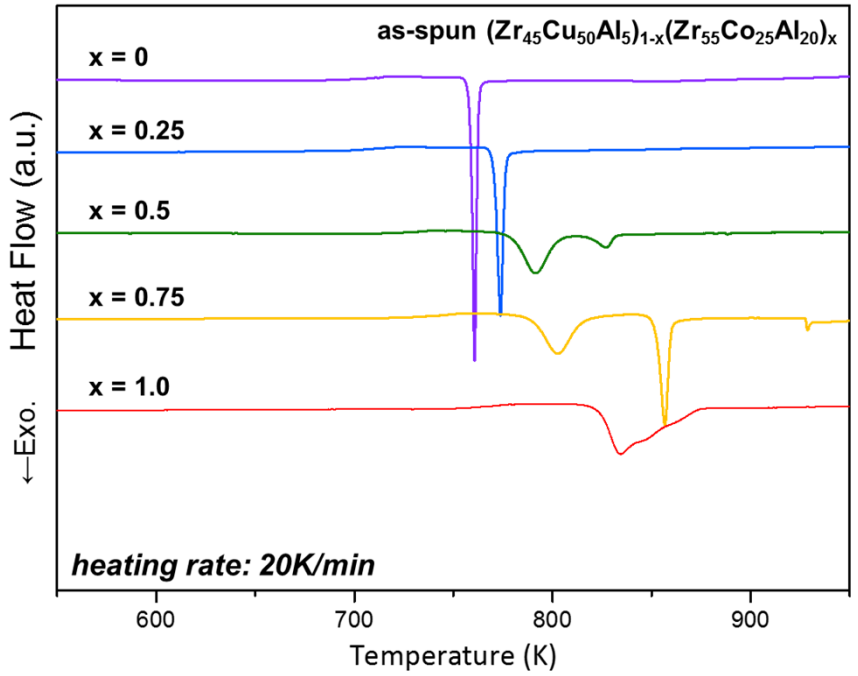


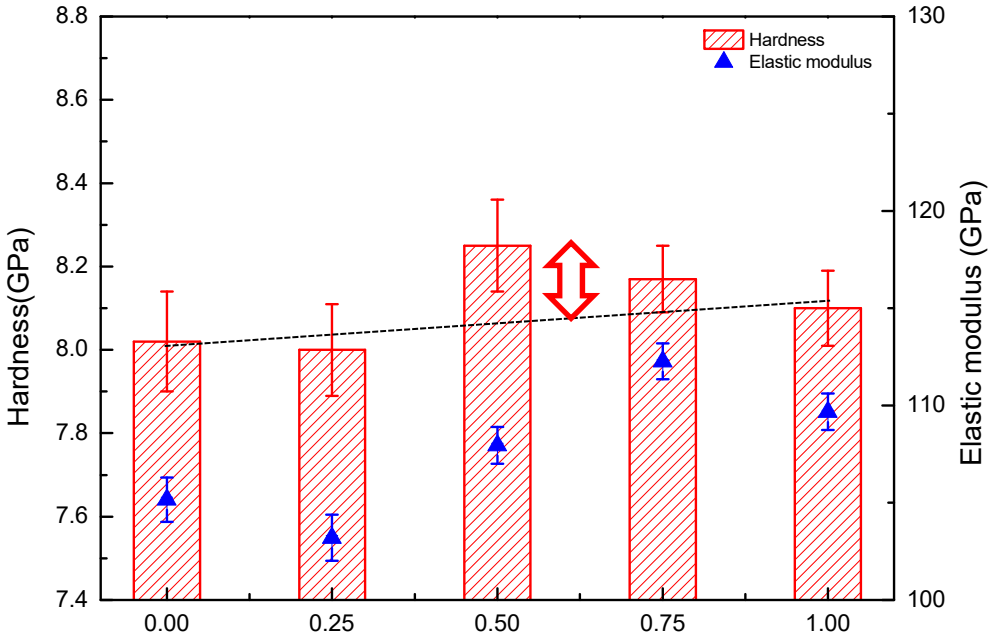
Compositional dependences of the temperature of liquidus line 기

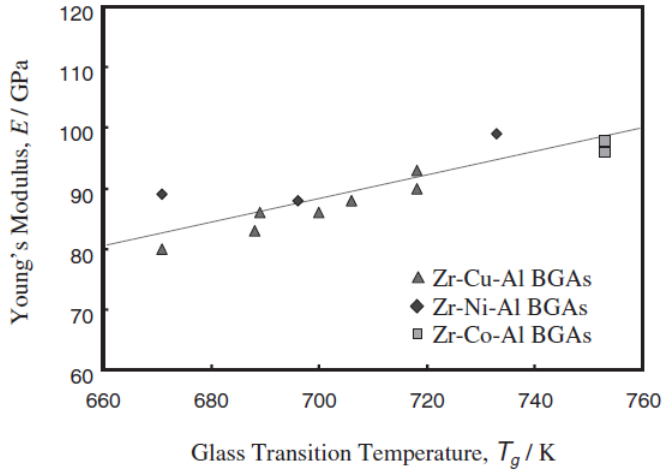


Chemical effect on bulk metallic glass



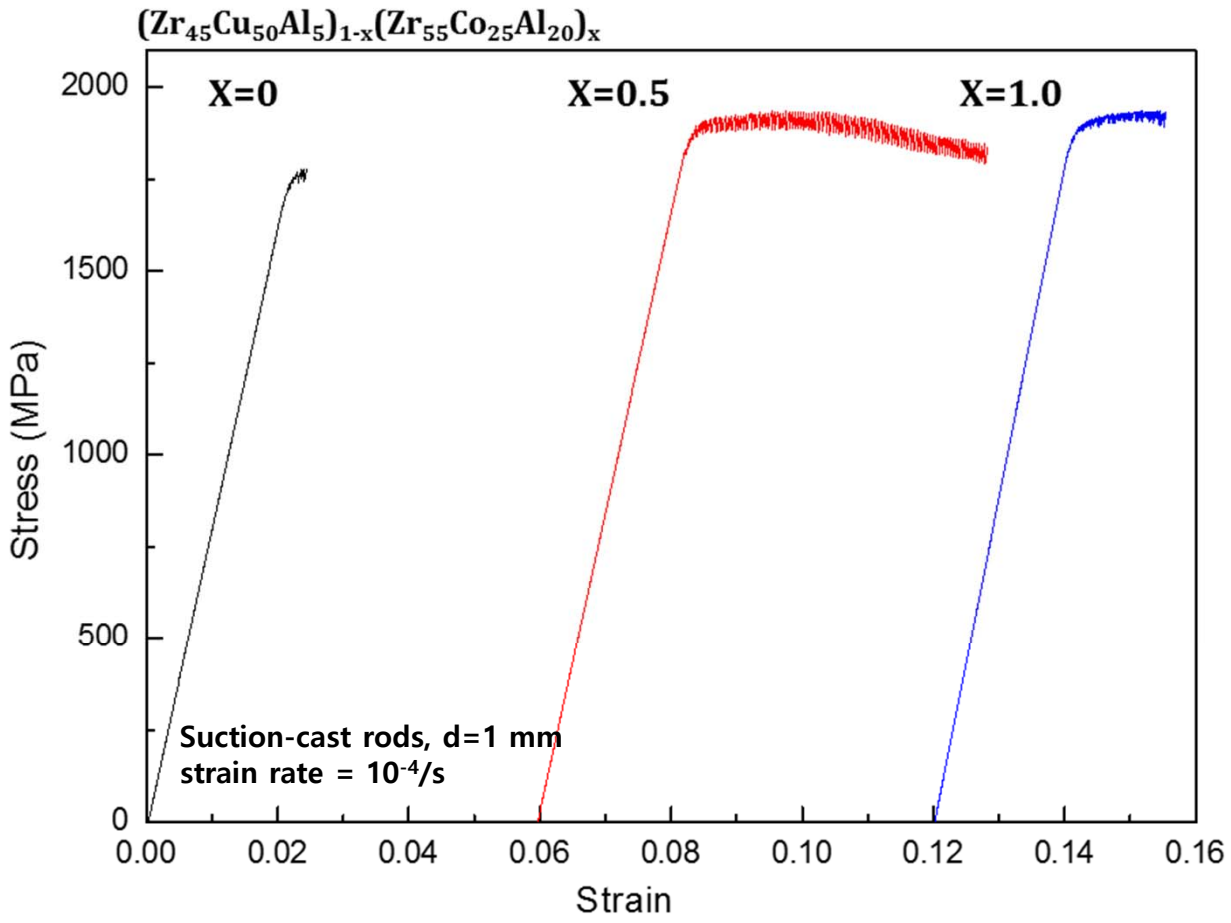






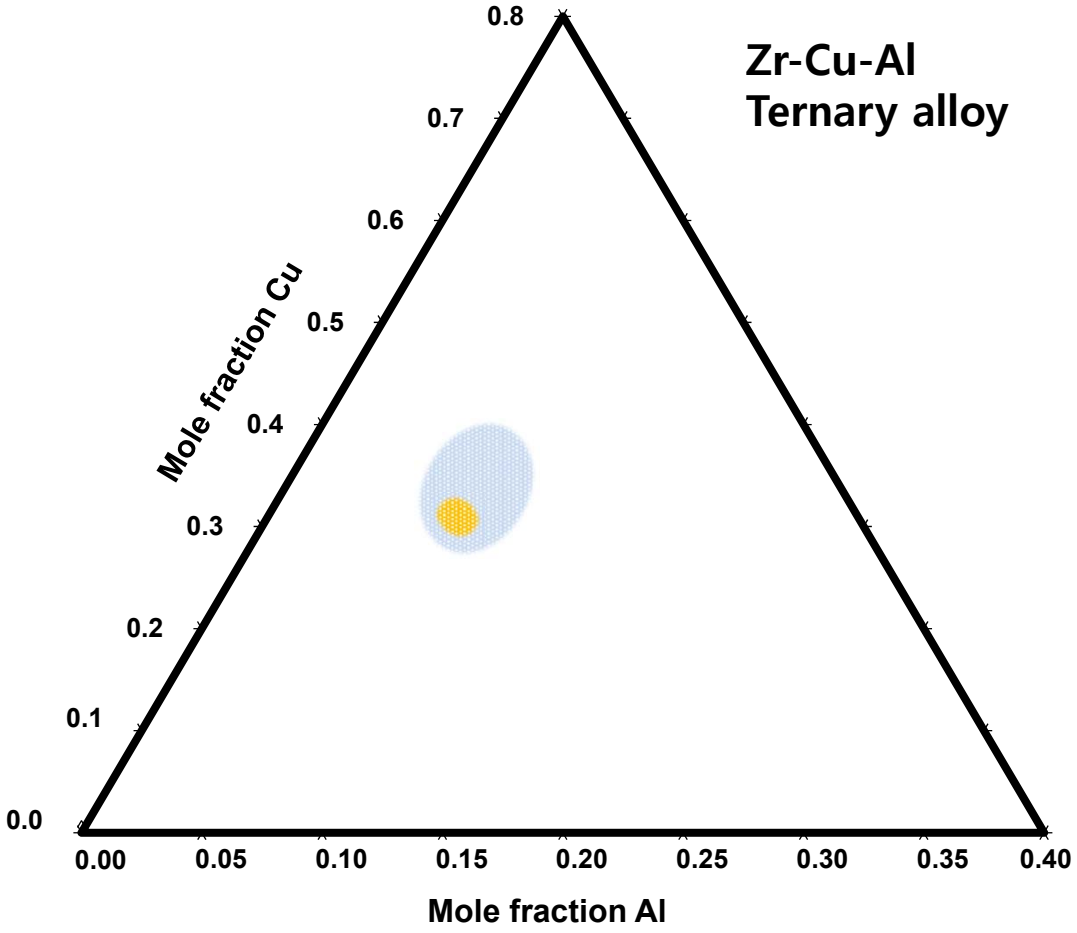
Yokoyama, Yoshihiko, et al. *Materials transactions* 48.7 (2007)

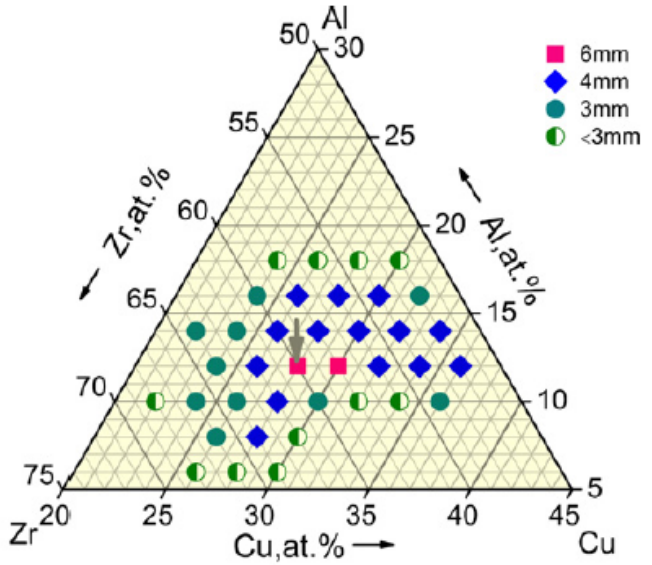
Bulk compression test



Effect of positive mixing enthalpy between Cu and Co

Bulk metallic glass forming composition

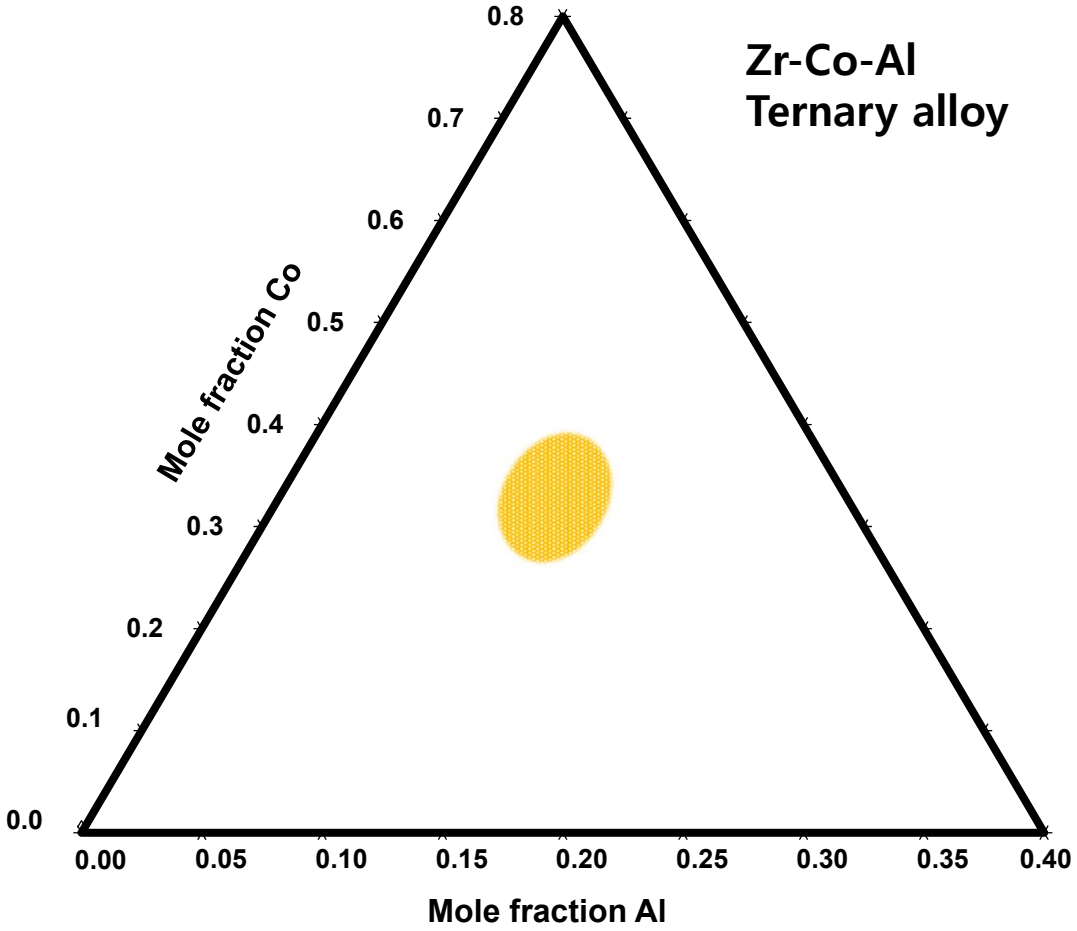


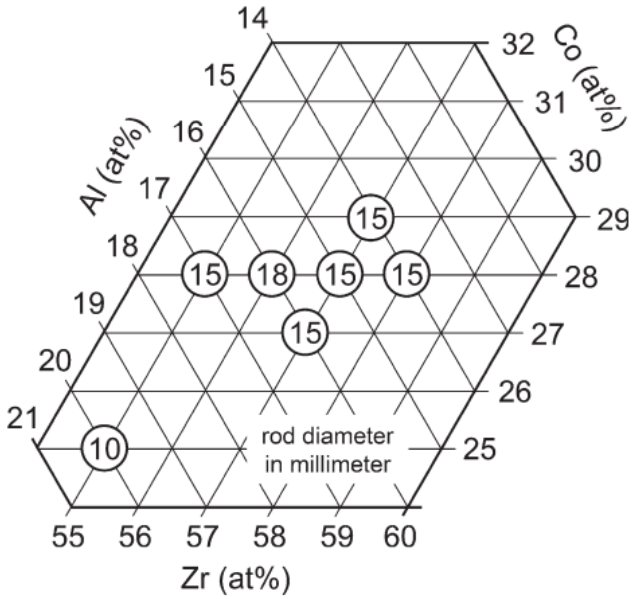


He, Qiang, et al. *Acta Materialia* 59.1 (2011): 202-215.

25~35 at% Cu, 10~16 at% Al → Bulk metallic glass forming composition

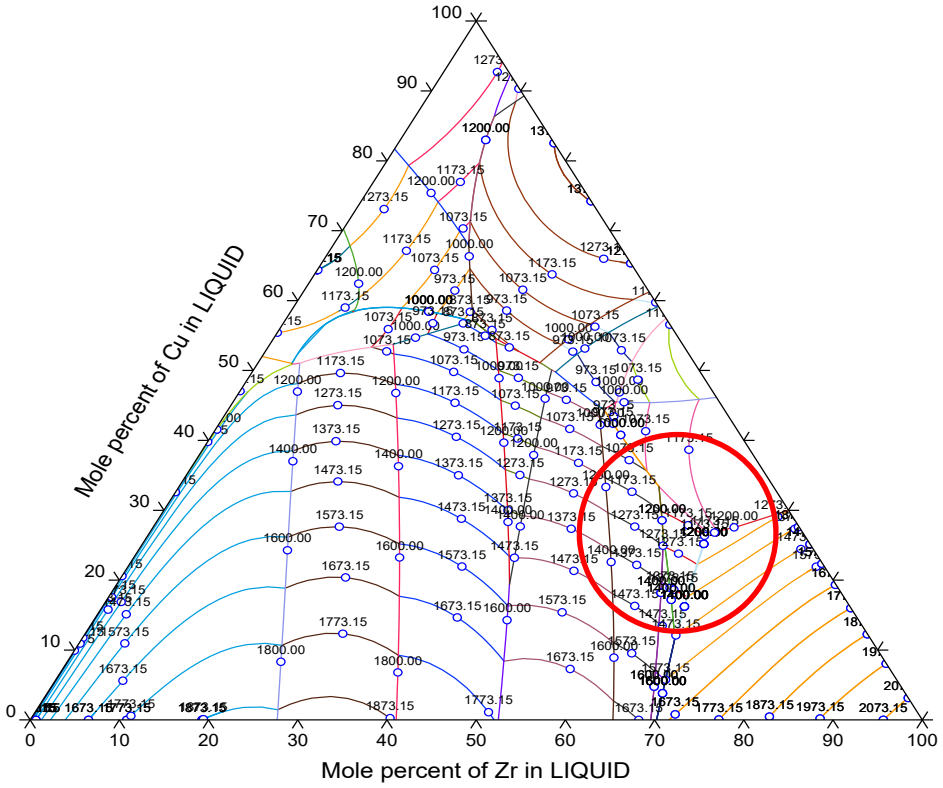
Bulk metallic glass forming composition

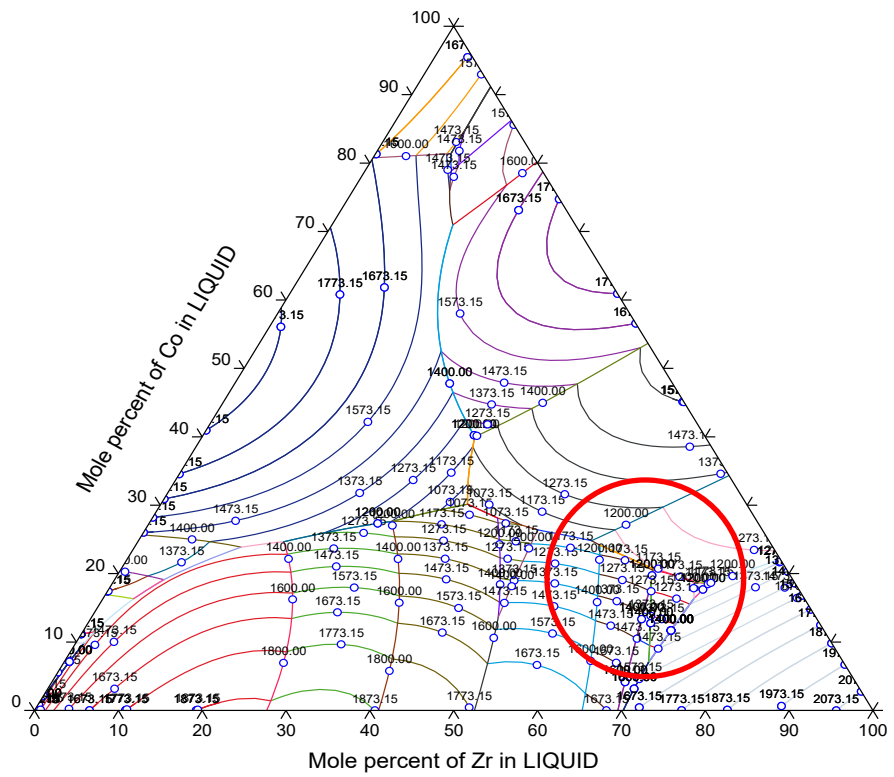




25~30 at% Co, 17~21 at% Al → Bulk metallic glass forming composition

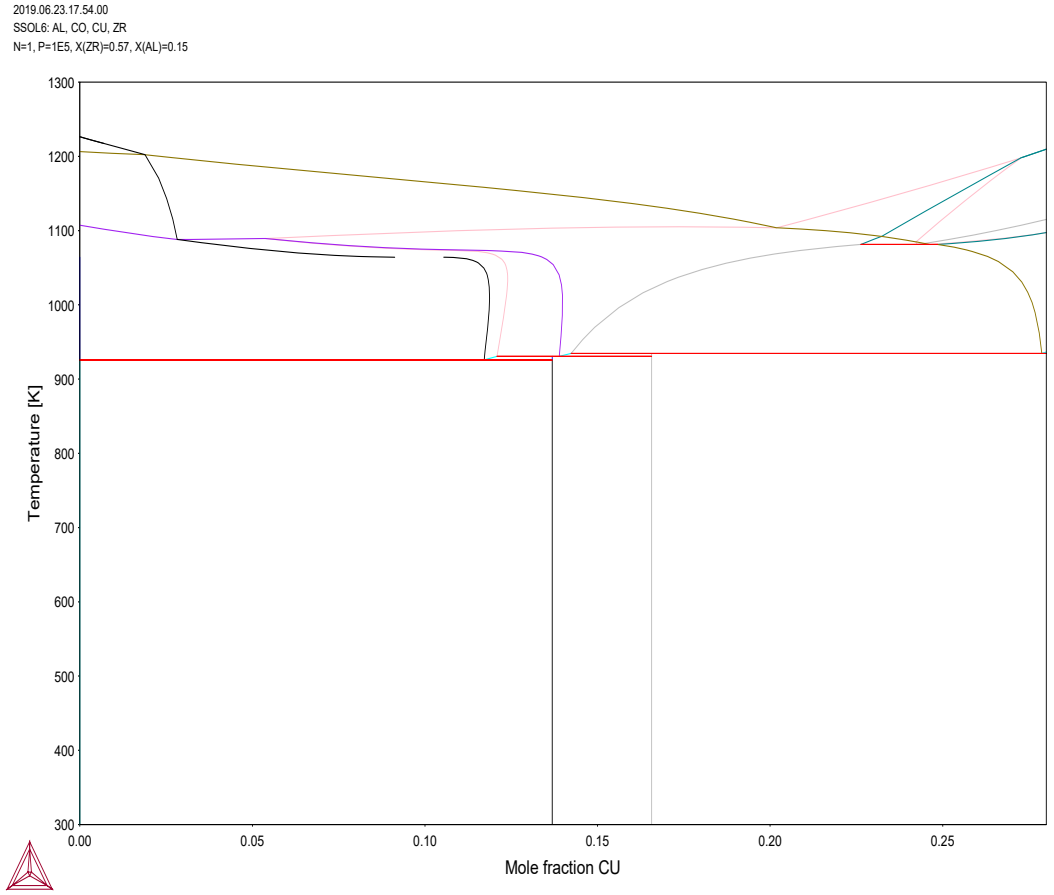
Pseudo-binary phase diagram





Pseudo-binary phase diagram

Zr57Co28Al15 – Zr57Cu28Al15



No intermetallic are founded

Thank you for kind attention