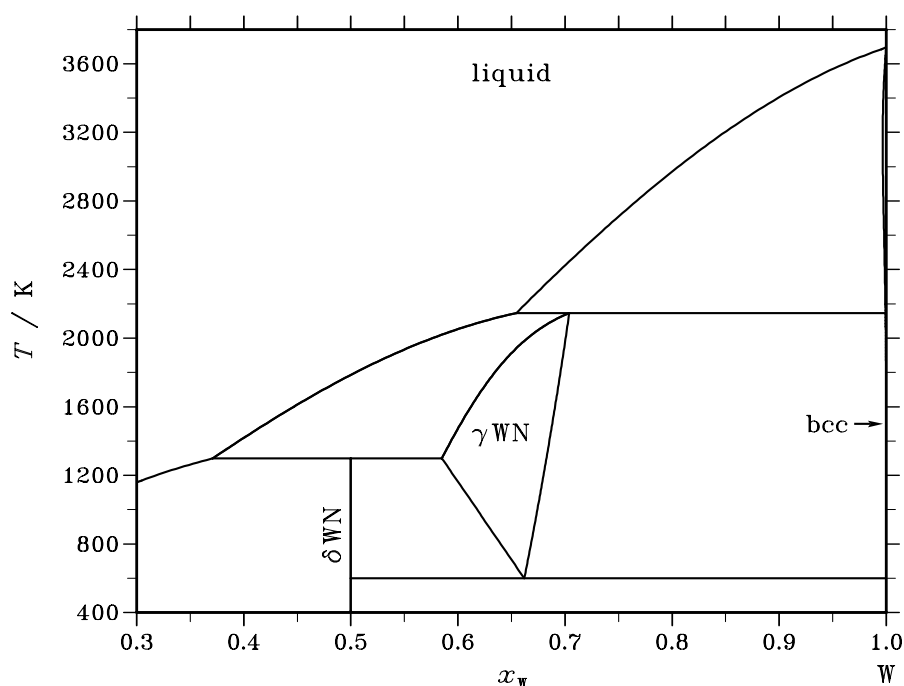


**N – W (Nitrogen – Tungsten)****Fig. 1.** Calculated phase diagram for the system N-W.

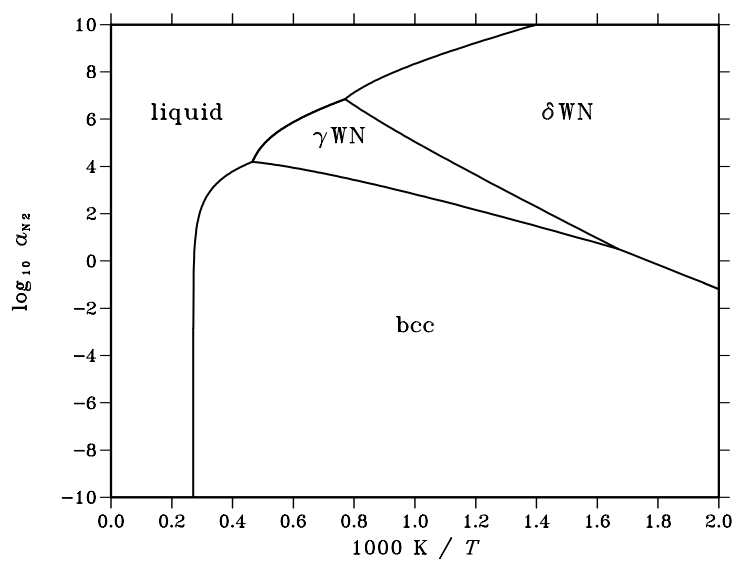
W is the base element in hard materials where the WC carbide gives high strength. Hard materials are often coated with various carbides and nitrides but there are no stable W nitrides. In the calculated phase diagram shown in Fig. 1 the gas phase has been suppressed. Both elements are also used as alloying elements in tool steels. An assessment of the N-W system has been reported by [93Fer].

**Table I.** Phases, structures and models.

Phase	Struktur- bericht	Prototype	Pearson symbol	Space group	SGTE name	Model
liquid					LIQUID	(N,W) <sub>1</sub>
δWN	<i>B<sub>h</sub></i>	WC	<i>hP2</i>	<i>P6̄m2</i>	DELTA_WN	W <sub>1</sub> N <sub>1</sub>
γWN	<i>B1</i>	NaCl	<i>cF8</i>	<i>Fm3̄m</i>	FCC_A1	W <sub>1</sub> (N,□) <sub>1</sub>
bcc	<i>A2</i>	W	<i>cI2</i>	<i>Im3̄m</i>	BCC_A2	W <sub>1</sub> (N,□) <sub>3</sub>

**Table II.** Invariant reactions.

Reaction	Type	<i>T</i> / K	Compositions / <i>x<sub>W</sub></i>			$\Delta_r H$ / (J/mol)
liquid + bcc $\rightleftharpoons$ γWN	peritectic	2146.7	0.655	0.999	0.704	−18979
liquid + γWN $\rightleftharpoons$ δWN	peritectic	1298.6	0.371	0.585	0.500	−19042
γWN $\rightleftharpoons$ δWN + bcc	eutectoid	599.4	0.662	0.500	1.000	−4655



**Fig. 2.** Calculated temperature-activity phase diagram. Reference state:  $\frac{1}{2}\text{N}_2(\text{gas}, 0.1 \text{ MPa})$ .

**Table III.** Standard reaction quantities at 298.15 K for the compounds per mole of atoms.

Compound	$x_{\text{W}}$	$\Delta_{\text{f}}G^{\circ} / (\text{J/mol})$	$\Delta_{\text{f}}H^{\circ} / (\text{J/mol})$	$\Delta_{\text{f}}S^{\circ} / (\text{J}/(\text{mol}\cdot\text{K}))$	$\Delta_{\text{f}}C_{\text{p}}^{\circ} / (\text{J}/(\text{mol}\cdot\text{K}))$
$\delta\text{WN}$	0.500	−11730	−24982	−44.447	0.099

## References

- [93Fer] A. Fernández Guillermet, S. Jonsson: *Z. Metallkd.* **84** (1993) 106–117.