creasing tempering temperatures up to 700-800°C the microstructure and strength of the alloys are about the same as those of annealed samples. The mechanical properties of the samples rapidly heated to high temperatures and cooled in air are almost unchanged by subsequent tempering at 600-800°C.

CONCLUSIONS

1. We have investigated two-phase alloys of titanium with aluminum and molybdenum and titanium with aluminum, molybdenum, and vanadium. These alloys are greatly affected by the thermal welding cycle and lose their plasticity and resilience when cooled rapidly after welding.

2. Welding followed by slow cooling (20-25°/sec) from 700-900°C ensures higher plasticity and resilience in the heat-affected zone in both alloys.

3. To restore the plasticity and resilience of the metal in the heat-affected zone to their initial values we recommend tempering at 750-800°C with subsequent cooling in air.

HIGH TEMPERATURE HEAT TREATMENT OF TITANIUM ALLOYS CONTAINING THE UNSTABLE β-PHASE

V. I. Dobatkin and G. A. Bochvar

Translated from Metallovedenie i Termicheskaya Obrabotka Metallov, No. 2, pp. 59-62, February, 1963

We investigated some peculiarities of the structure and properties of a BT15 alloy resulting from heat treatment at temperatures exceeding the quenching temperature by 200-300°C.*

The alloy was prepared by the double smelting method from TG00 titanium sponge containing 0.08-0.11% O₂, 0.03% N₂, and 0.005-0.007% H₂ and molybdenum, aluminum, and chromium in amounts recommended for the BT15 alloy.

Rods 14 x 14 mm were forged from the ingots. The on die temperature was 1000-1100°C and the finishing temperature was 700-800°C. The initial material was a billet 70 x 70 mm in cross section and 150-200 mm long.

Cast and forged samples 14 x 14 mm in cross section were heat-treated in furnaces.

The mechanical properties of forged samples of the BT15 alloy after quenching from different temperatures are given in Fig. 1. The mechanical characteristics of forged samples after 30 min at 1100°C and 2 h at the quenching temperature followed by cooling in water are given in the same figure.

Quenching from 800-900°C results in maximum plasticity. The plasticity decreases with increasing quenching temperatures.

The plasticity of the samples heated to 1100°C before quenching is considerably lower than the plasticity of the quenched samples.

The same result is obtained when the samples are quenched from 1100°C to room temperature in water followed by heating to a given temperature. Heating to high temperatures sharply affects the resilience of the samples.

* T. N. Ryzhova participated in this work.
The values of resilience after different heat treatments are given in Table 1.

These data show that the resilience decreases by more than a factor of two when the quenching temperature is increased from 900 to 1100°C (for 30 min). Treatment No. 4 (see Table 1) decreases the resilience very sharply.

The values of δ and ψ for samples quenched from different temperatures and also after short periods of aging at 450°C following quenching are given in Table 2.

This table shows that the detrimental effect of high temperature heat treatment is particularly great when quenching is followed by aging.

Study of the macrostructure and the fracture showed that the grains grow very intensely at temperatures above 900°C. Figure 2 represents the structure of fractures in forged samples quenched from 900, 1000, and 1100°C. For the sake of comparison we have also represented the structure of a cast sample.