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## Consolidation and Fabrication Techniques for Vanadium-20 w/o Titanium (TV-20)

In recent years, there has been an increasing need for information on the possible use of vanadium or vanadium alloys as materials for fast-reactor fuel-element cladding or jacketing. The fast-reactor service imposes rigorous demands upon the cladding and other structural components, and those demands are not easily satisfied. The material should possess adequate high-temperature properties (including strength and integrity), good thermal conductivity, compatibility with nuclear fuels and with liquid-metal coolants, and stability under irradiation. Finally, the material must be fabricable into the desired shapes, such as high-quality, small-diameter, thin-wall tubing and related structures.

TV-20 met tests of mechanical properties, fuel compatibility, sodium corrosion, and irradiation behavior, thus studies on tubing fabrication techniques were instigated.

The first report, published in February 1965, presents methods for the consolidation and fabrication of bar, rod, sheet, and high-quality, small-diameter (L5 mm), thin-wall (L0.5 mm) tubing of a V-20, w/o Ti (TV-20) alloy.

Additional evaluation of the alloy includes annealing and other heat-treatment studies and pertinent room-temperature, mechanical-property tests. Early results of industrial participation in the program are contained in the report.

The second report, published in May 1966, includes recent improvements in the consolidation and fabrication techniques for TV-20. Major emphasis is placed on tubing fabrication with significant progress having been made in tube-blank extrusion, tube reducing, and drawing. Product evaluation details are given and recommendations are made for further research.

### Notes:

1. This information may prove to be a useful reference for persons involved in the metallurgical studies and the metal working of titanium and vanadium alloys. Manufacturers of reactors may also find this information of interest.
2. A fully integrated consolidation and fabrication program, having as its end result the delivery of high quality TV-20 bar, rod, sheet and tubing, has been produced by W. R. Burt, Jr., W. C. Kramer, R. D. McGowan, F. J. Karasek, and R. M. Mayfield of Argonne National Laboratory. The details are fully discussed in their reports: "Consolidation and Fabrication Techniques for Vanadium-20 w/o Titanium (TV-20)," ANL-6928, February 1965; and "Improvements in Consolidation and Fabrication of Vanadium-20 w/o Titanium (TV-20)," ANL-7127, Argonne National Laboratory, May 1966, both available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151, price \$3.00 each (microfiche \$0.65).
3. Inquiries concerning this innovation may be directed to:

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(continued overleaf)

**Patent status:**

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