October 1975

B75-10271

NASA TECH BRIEF

Lyndon B. Johnson Space Center

Influence of Heat Treatment on Mechanical Properties of 300M Steel

Tests have been conducted on 300M steel to determine the heat treatment that yields the best combination of strength and thickness. Bar stock with thicknesses of 0.5 in. (1.27 cm) and 1 in. (2.54 cm) was evaluated. The specimens were austenitized for 1 hour in a vertical tube furnace in a continuously-flowing helium atmosphere. They were then quenched in oil at room temperature and were double tempered (2 hours each time) in a salt bath. Austenitizing and tempering were conducted under the following temperatures:

Austenitizing		Tempering	
°F	(K)	°F	(K)
1,600	(1,140)	Untempered	
1,800	(1,260)	400	(480)
2,000	(1,370)	600	(590)
2,200	(1,480)	800	(700)
		1,000	(810)

Test results for both bar stock thicknesses were similar. Data indicated that tensile strength decreased monotonically with tempering temperature for all austenitizing treatments. Yield strength, on the other hand, rose rapidly with tempering to approximately 600° F (590 K) after which it decreased. Fracture toughness for samples austenitized at 1,600° F (1,140 K) rose slowly and monotonically with tempering temperature. Maximum toughness was obtained from samples austenitized at temperatures exceeding 1,800° F (1,260 K), using a tempering temperature of 494° F (530 K). Thereafter, the toughness decreased as the tempering temperature was raised, reaching a minimum at 800° F (700 K).

On the basis of the observed results, it is concluded that the 300M steel should be austenitized at temperatures above 1,800° F (1,260 K). Tempering should be performed at temperatures between 400° and 600° F (480 and 590 K). Tempering at temperatures of 800° F (700 K) or over should be avoided. These results apply to steel section thicknesses of 1 in. (2.54 cm) or less. Additional work is required to establish these characteristics for thicker sections.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Johnson Space Center
Code AT3
Houston, Texas 77058
Reference: TSP75-10271

Patent status:

NASA has decided not to apply for a patent.

Source: J. L. Youngblood
Johnson Space Center and
M. Raghavan of
National Research Council
(MSC-14792)

Categories: 04 (Materials)
06 (Mechanics)