

# The Temperature Dependence of Tensile Properties for Alloy 25, Alloy 3 and ToughMet® 3 Alloys

The temperature dependence of the tensile properties for various tempers of ToughMet 3 alloy (C72900), Alloy 25 (C7200) and Alloy 3 (C17510) were measured from -320 °F (-195 °C) to 650 °F (343 °C) in accordance with ASTM E21. All of these copper alloys showed increased strength at sub-zero temperature and a loss of strength and ductility at elevated temperature.

## Elevated Temperature Properties

The standard specifications for alloys from Materion Performance Alloys provide tensile properties at “room temperature” (about 72F/22C). When designing with these materials at other temperatures, knowledge of the temperature dependence of the tensile properties is needed. To provide this information, Materion has measured the temperature dependence of the tensile properties for standard tempers of ToughMet 3 alloy (C72900), Alloy 25 (C7200) and Alloy 3 (C17510). Testing was performed in accordance with ASTM E21, “Standard Test Methods for Elevated Temperature Tension Tests of Metallic Materials.”

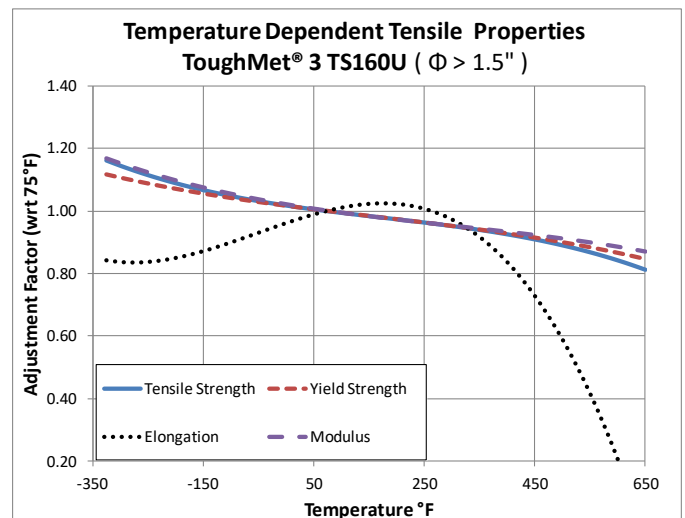
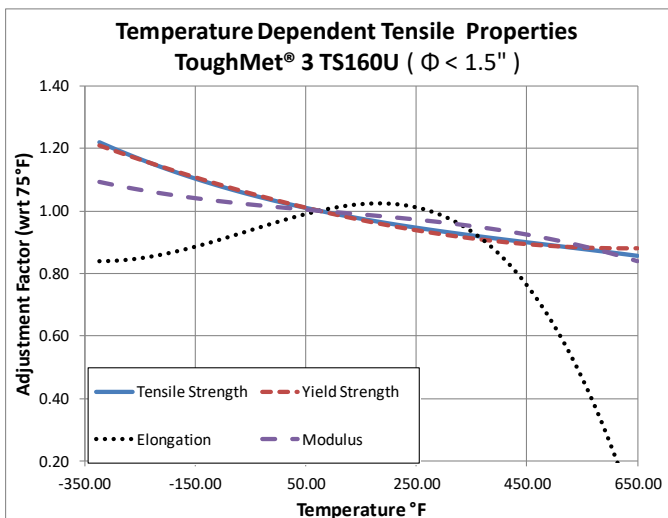
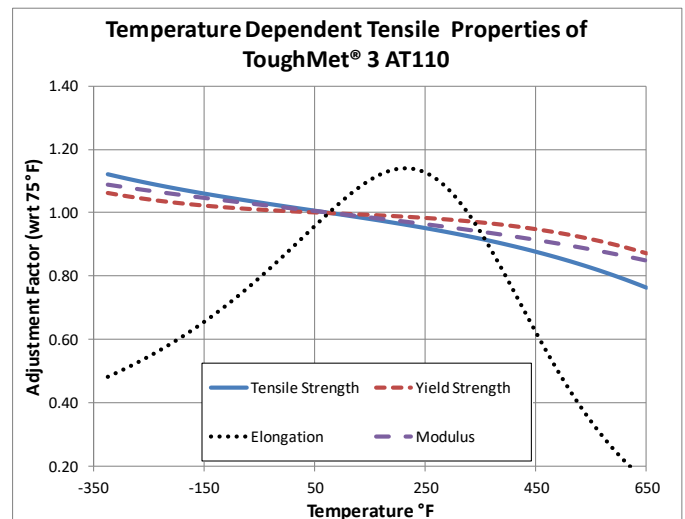
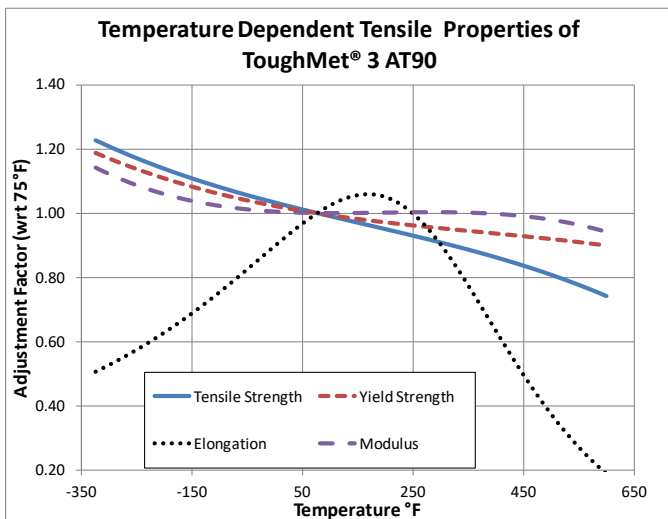
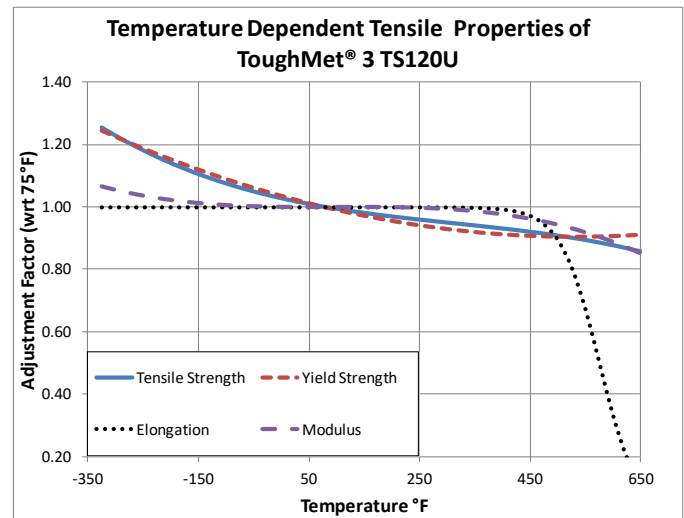
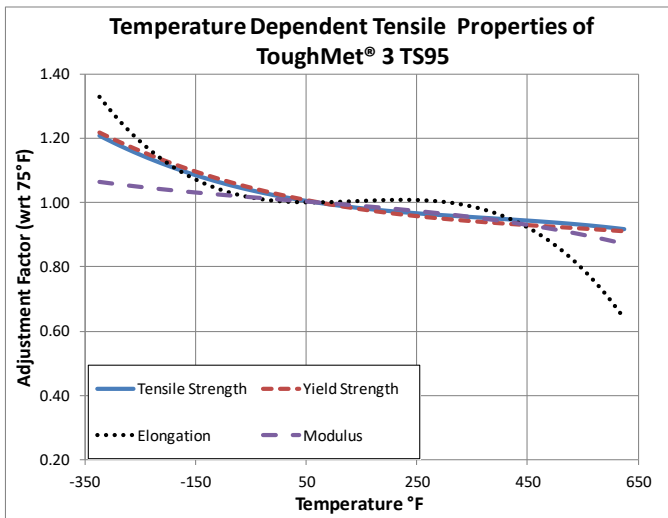
When designing below room temperature, these short temperature exposure tensile tests are usually adequate. At elevated temperature, especially above 400F/200C, elevated temperature aging response and creep rupture data will also need to be considered. Materion Tech Brief AT0061, “The Temperature Stability of Alloy 25, Alloy 3 and ToughMet® 3 alloy Tensile Properties up to 650°F/340°C,” details the permanent changes to room temperature tensile properties for Materion alloys exposed to elevated

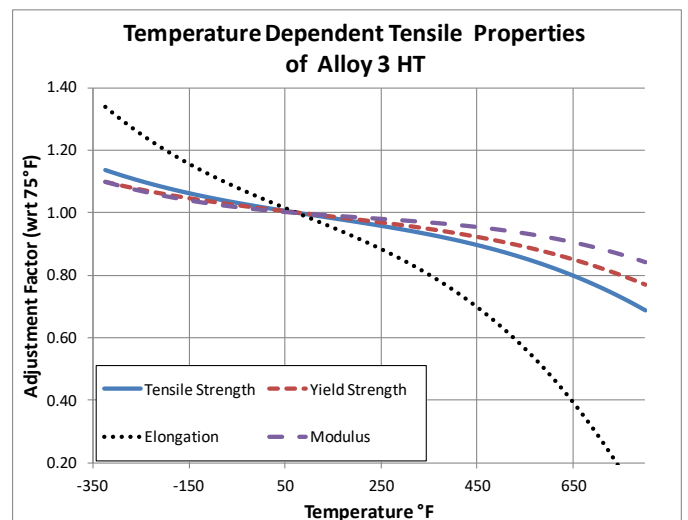
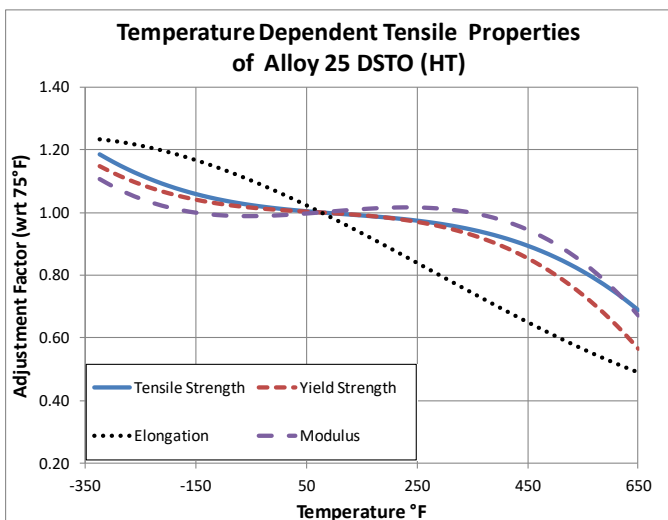
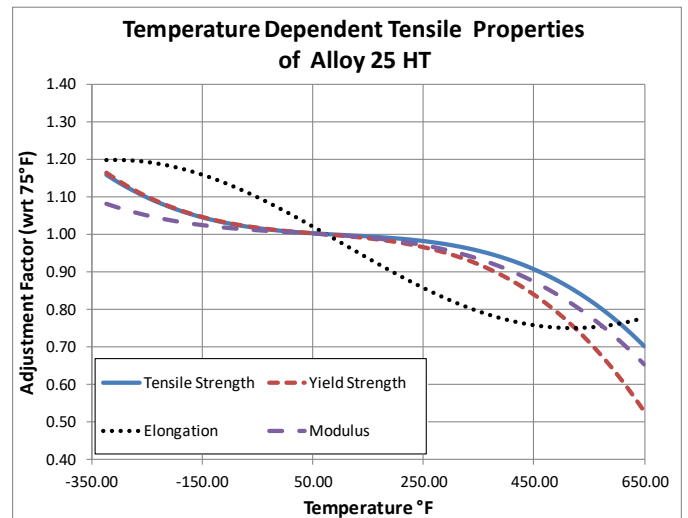
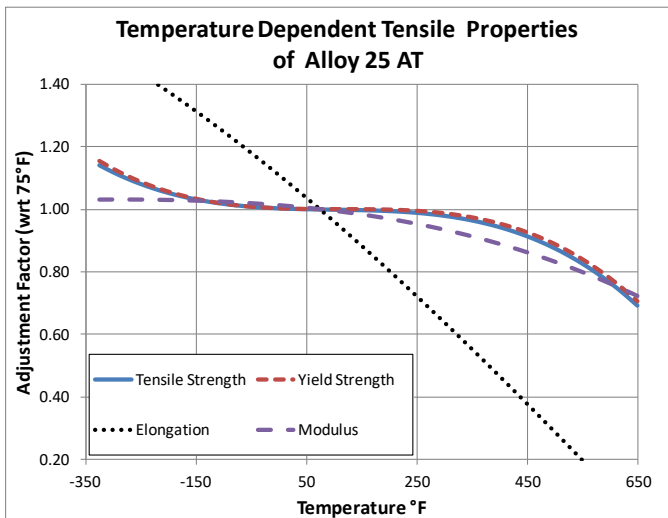
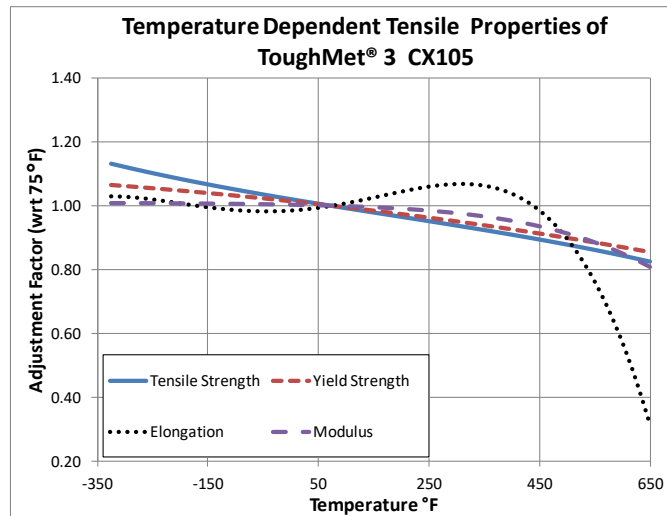
temperature. Documentation of other effects of high temperature such as creep and stress rupture data may be available from the Material Technical Services.

## Temperature Dependence Graphs

The graphs below show the temperature dependence of the ultimate tensile strength, 0.2% offset yield strength, elongation (4D) and elastic modulus. These are all plotted as the ratio with respect to their value at room temperature. The minimum test temperature was -320 °F (-196 °C), the temperature of liquid nitrogen. The maximum test temperature was 650 F (343 C). For elevated temperatures, the samples were soaked for 30 minutes before testing.

Each graph represents data from one heat of the material. They show the general behavior of these alloys but are not guaranteed for use as specific design values. For additional literature, further information, or technical assistance contact Materion Performance Alloys at (800)-375-4205 or [BrushAlloys-Info@materion.com](mailto:BrushAlloys-Info@materion.com).





## SAFE HANDLING OF COPPER BERYLLIUM

Handling copper beryllium in solid form poses no special health risk. Like many industrial materials, beryllium-containing materials may pose a health risk if recommended safe handling practices are not followed. Inhalation of airborne beryllium may cause a serious lung disorder in susceptible individuals. The Occupational Safety and Health Administration (OSHA) has set mandatory limits on occupational respiratory exposures. Read and follow the guidance in the Material Safety Data Sheet (MSDS) before working with this material. For additional information on safe handling practices or technical data on copper beryllium, contact Materion Performance Alloys, Technical Service Department at 1-800-375-4205.