# T014: Negative Value in Flow Stress Error Message

## Introduction

*This article describes why "Zero or negative value in log interpolation" (2D) and "Warning: failure in log extrap. of flow stress" (3D) errors occur and how these errors can be resolved.*

## Problem Description

Material flow stress is a function of temperature, strain and strain rate. It is important to use a material that has flow stress data defined for the complete range of temperatures, strains and strain rates that the workpiece will experience during the forming process. If one of these state variables exceeds the defined material data ranges then DEFORM will extrapolate the data in order to keep the simulation going. In some cases the extrapolated flow stress value can become a value less than or equal to zero. When this happens, DEFORM will provide the error message seen below.

2D Message

```
Program stopped by ERROR SFTC1006
Zero or negative value in log interpolation.
Check your flow stress material properties.
```

3D Message

```
Warning: failure in log extrap. of flow stress
Warning: failure in log extrap. of flow stress
Warning: failure in log extrap. of flow stress
Warning: failure in log extrap. of flow stress
Warning: failure in log extrap. of flow stress
  1  0.1779961364E+03  0.1346019480E-01  0.3199950737E-01      0.608
Warning: failure in log extrap. of flow stress
Warning: failure in log extrap. of flow stress
Warning: failure in log extrap. of flow stress
Warning: failure in log extrap. of flow stress
Warning: failure in log extrap. of flow stress
  2  0.1773125977E+03  0.1571919117E-02  0.2854759001E-01      1.728
Warning: failure in log extrap. of flow stress
Warning: failure in log extrap. of flow stress
Warning: failure in log extrap. of flow stress
Warning: failure in log extrap. of flow stress
Warning: failure in log extrap. of flow stress
  3  0.1773170973E+03  0.6384769677E-03  0.3722095919E-02      1.648
```

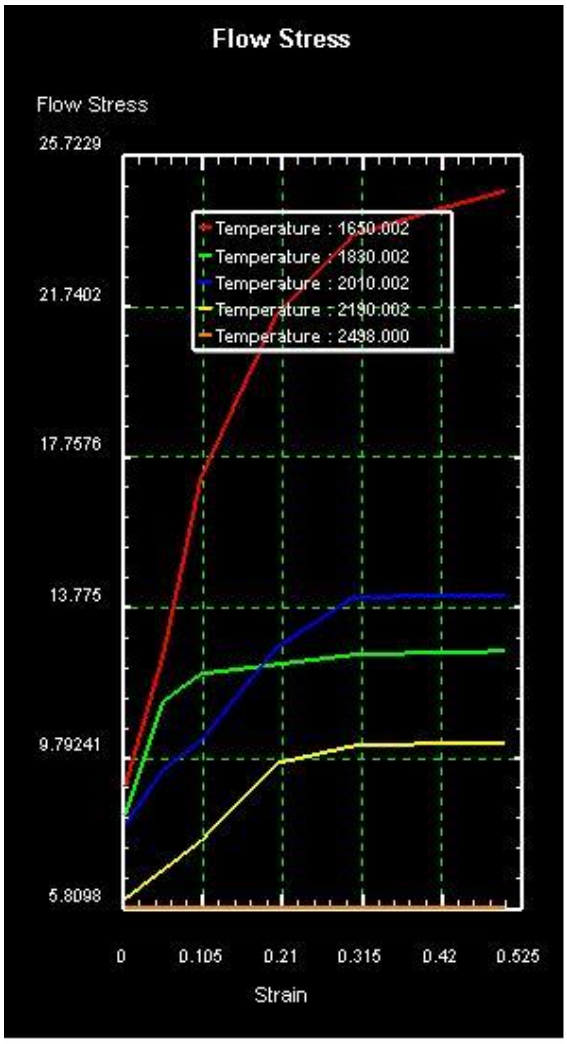
## Background Information

The most common reason for this error is a workpiece temperature that has exceeded the temperature range for the material. In general, the flow stress

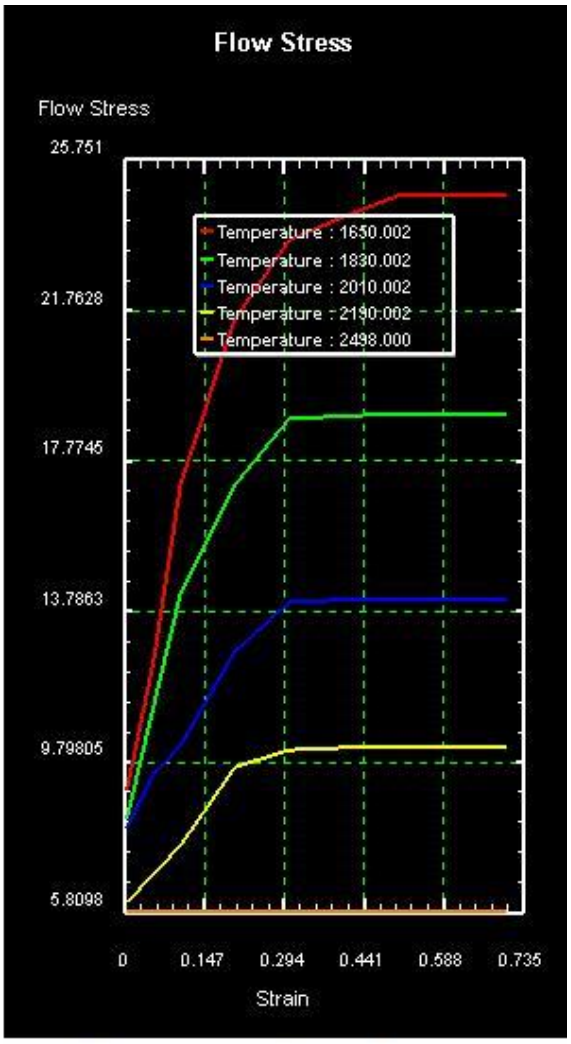
decreases as temperature increases. With this trend DEFORM will extrapolate to lower and lower values as the temperature is increased beyond the upper limit of the flow stress data.

This same phenomenon can occur with the strain and strain rate state variables, but this is uncommon. If the material is formed slowly, the low strain rate can drive a decreasing extrapolation of flow stress. Also, a material with flow softening (decreasing flow stress as a function of strain) may extrapolate a zero or negative value if the strain is taken beyond the limit of the data.

Another possible cause of negative flow stress extrapolation is flow stress data that contains overlapping curves.




Ovelapping Flow Stress

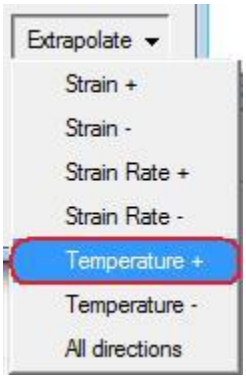



Corrected Flow Stress

# Solution

If the workpiece temperature has exceeded the temperature of the material data:

- Check the Steel_at_Extended_Temperatures folder for your material. Some of these materials are defined up to 2500F.
- You can use the TemperatureExtrapolation.xls spreadsheet to manually extrapolate the flow stress to a slightly higher temperature.
- Another option is to keep the flow stress from decreasing by adding a bounding temperature value (DEFORM: Extrapolate > Temperature +). This adds an extra temperature point with the same flow stress values as the previous high temperature. This gives the "flow stress vs temperature" curve a slope of zero. Thus, the flow stress will not change when extrapolated occurs at higher temperatures. This is not the most accurate method but sometimes it is the only way to get results. Please contact DEFORM Support if you are not sure whether this method is appropriate for your situation.




# Related Information

Link to temperature extrapolation Excel file.