

Subtask 2-4: Low-Temperature Properties

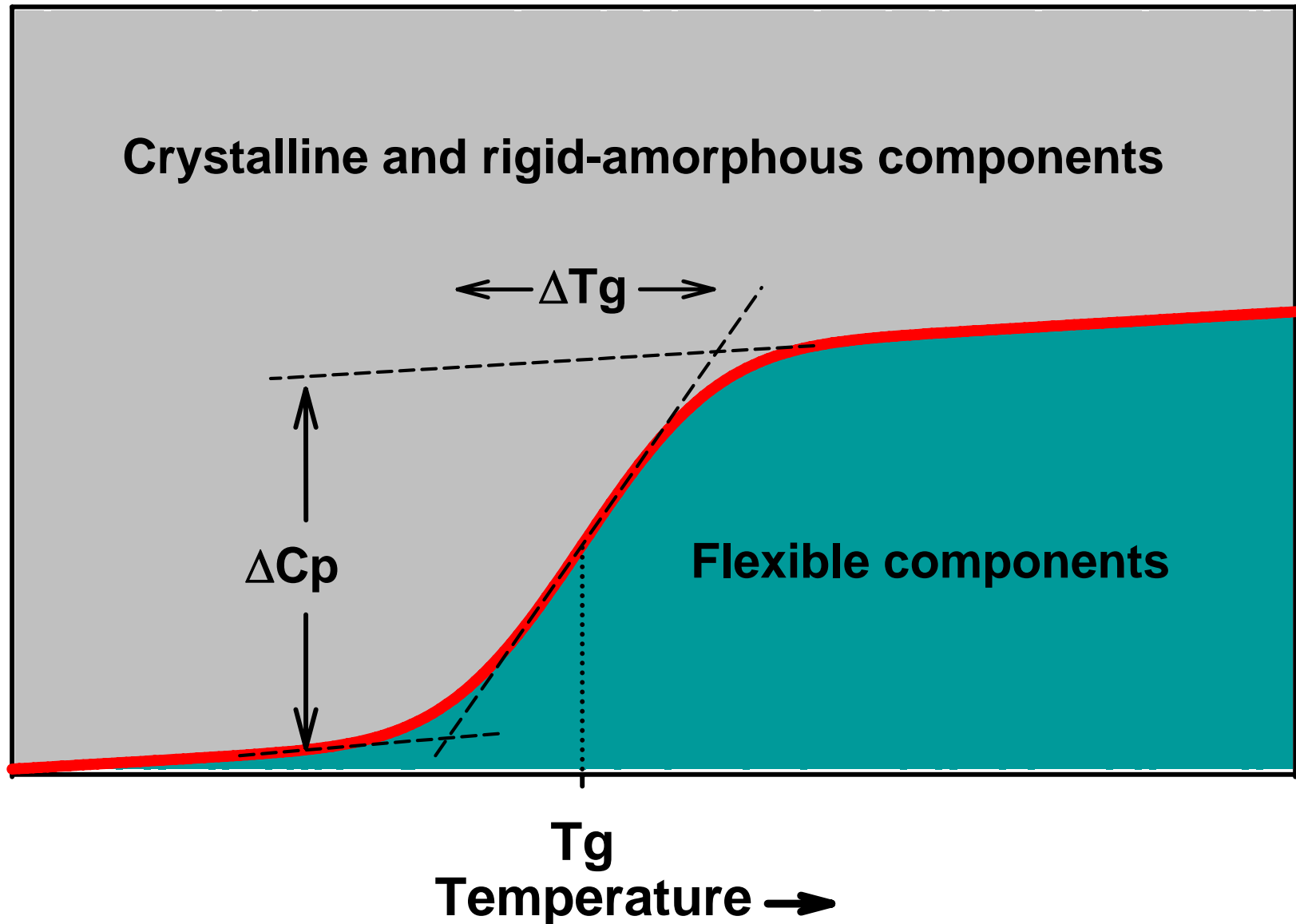
Subtask Manager: Fred Turner

Presented by Fred Turner

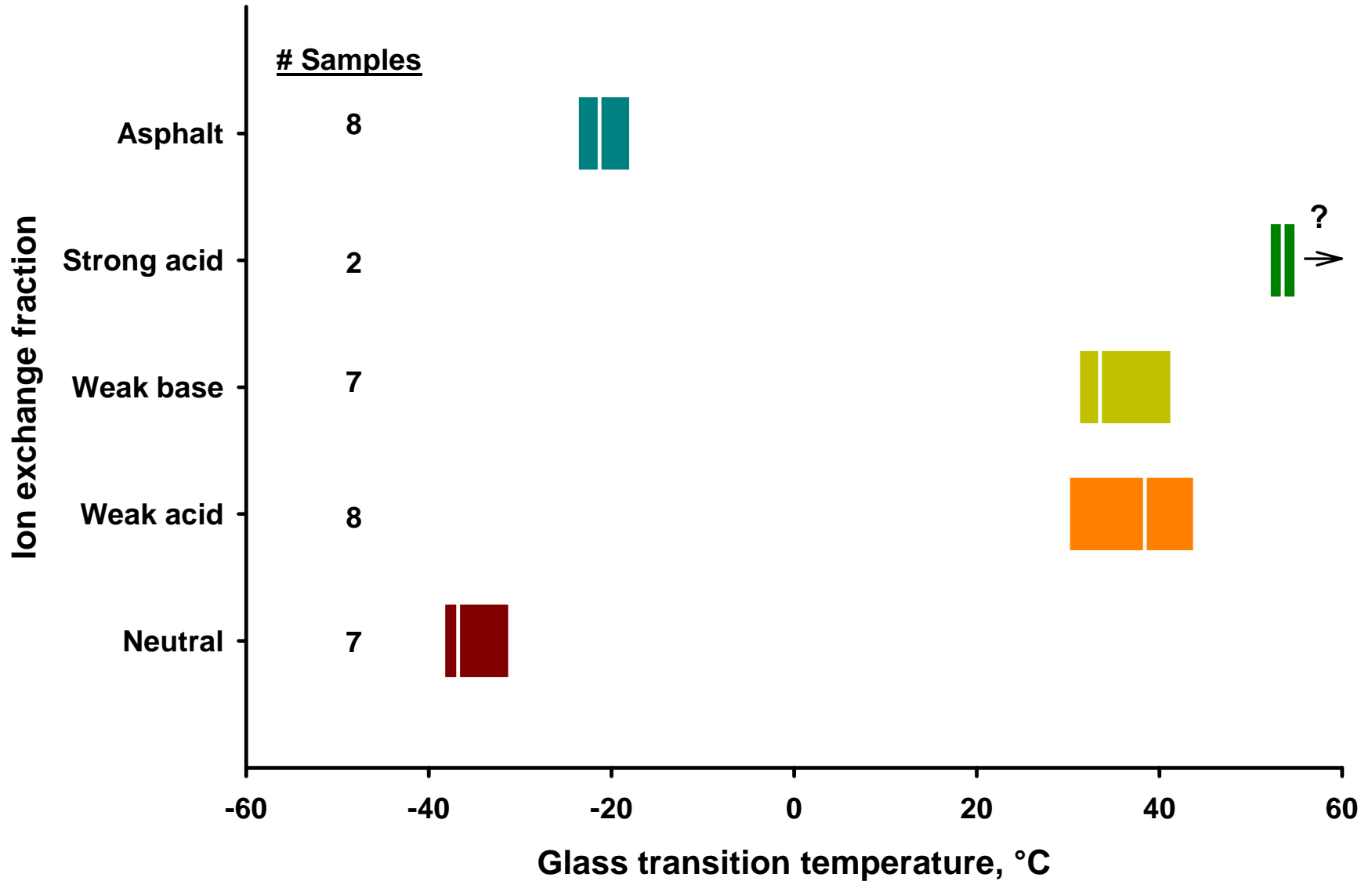
**ETG Meeting
Denver, CO
July 2007**

- 1. Glass Transition Region and Parameters**
- 2. Relationship of Glass Transition Parameters to Low-Temperature Specifications**
- 3. Wax and other Limitations on Structural Relaxation**
- 4. Research Direction and Examples**

Glass Transition Region and Parameters



Glass Transition in Asphalts

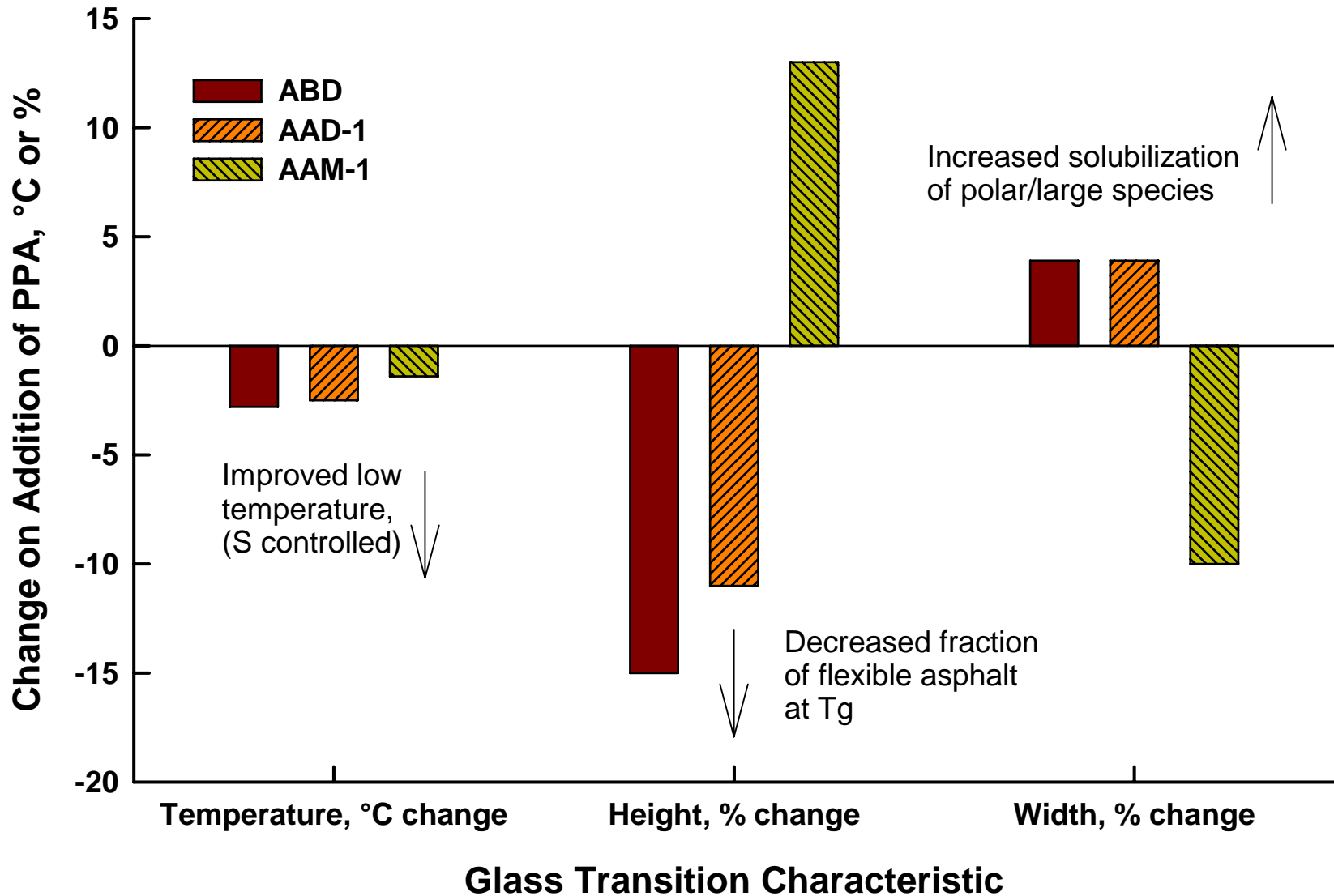


- **DSC measurements correlate with Superpave low-temperature specifications if S controls**
 - **Critical measurements are glass transition temperature, transition width, and CF or wax content**
 - **DSC methods depending only on the glass transition profile have not provided precise prediction of low-temperature specification if m controls**
 - **Because the measurements correlate well with S-control, DSC has been used extensively to monitor changes in asphalt low-temperature behavior with modification, aging, thermal treatments, fractionation, etc. – rapid, small sample**

- **Crystalline alkanes increase stiffness and decrease the rate of change of stiffness**
 - The extent of stiffening is determined by the amount of alkane present, the fraction of alkane that crystallizes, and microcrystalline wax content
 - Although crystallization occurs above the glass transition, the effect can be seen in measurements of relaxation near the glass transition
 - Other asphalt modifications can slow molecular mobility

 - DSC can be used to quantify some waxy modifiers -- Sasobit

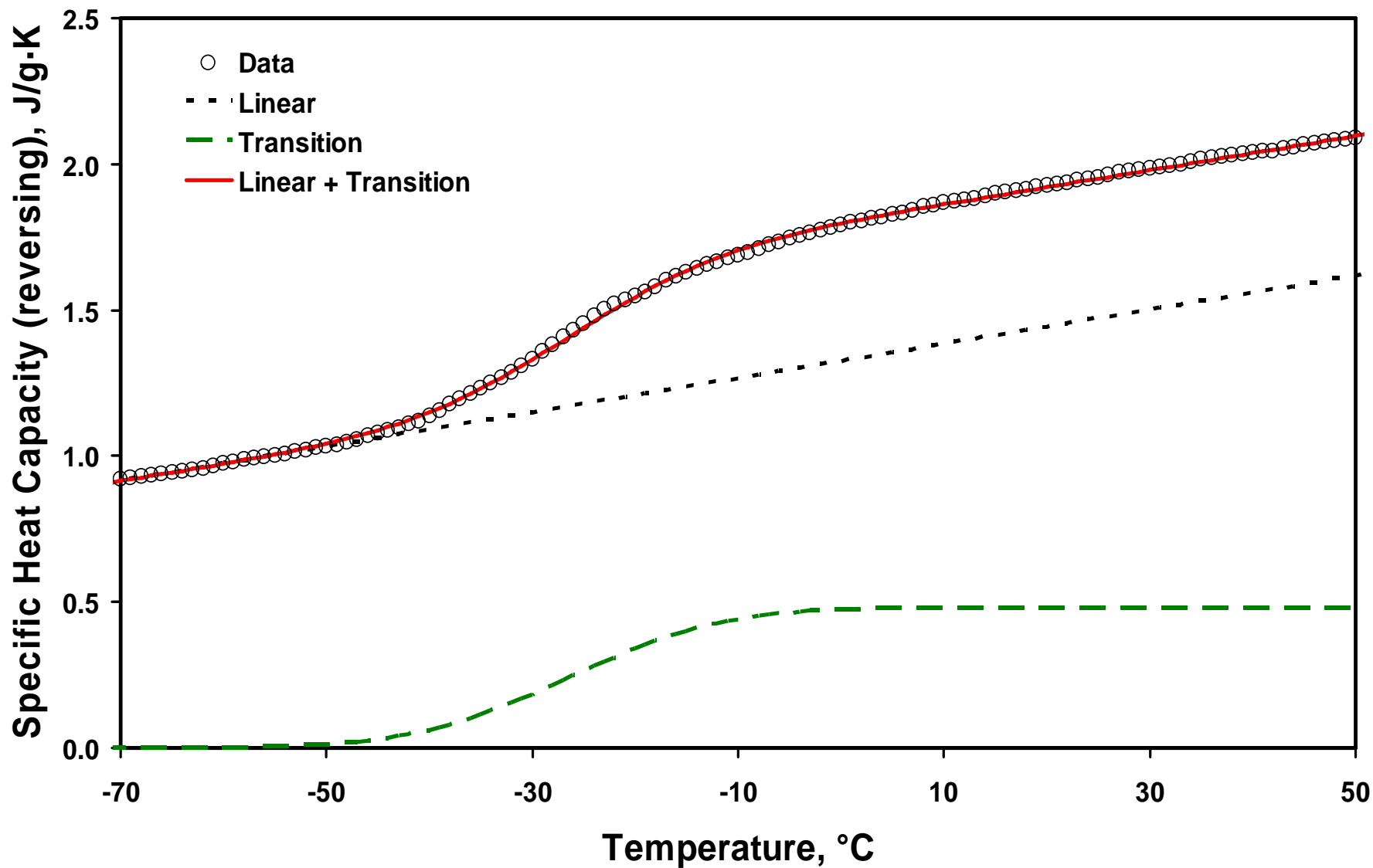
Glass Transition Changes on PPA Addition



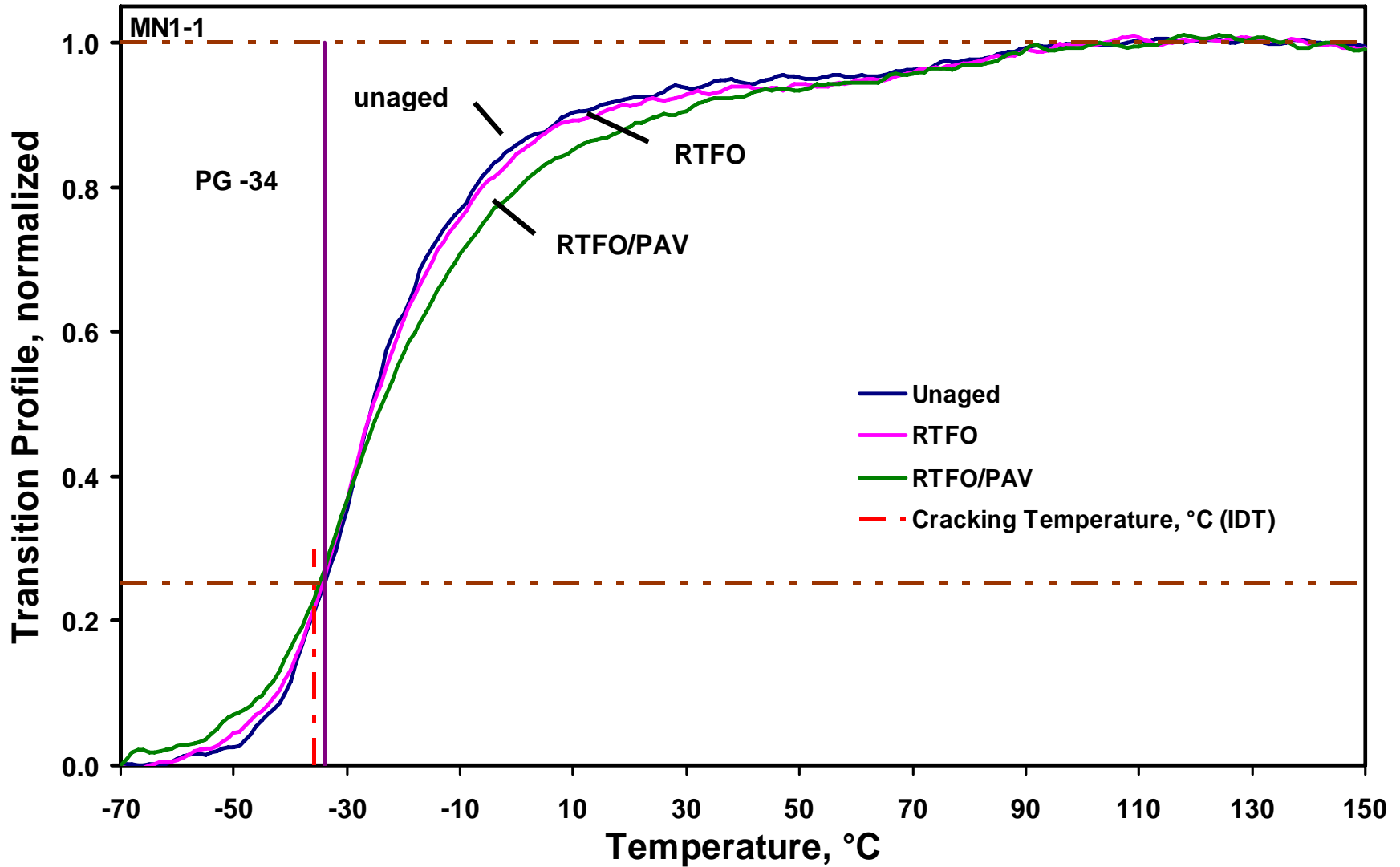
Subtask 2-4.1 Specification Correlation

Use existing glass transition heat capacity profiles to determine correlation of profile parameters with m-control low-temperature specification.

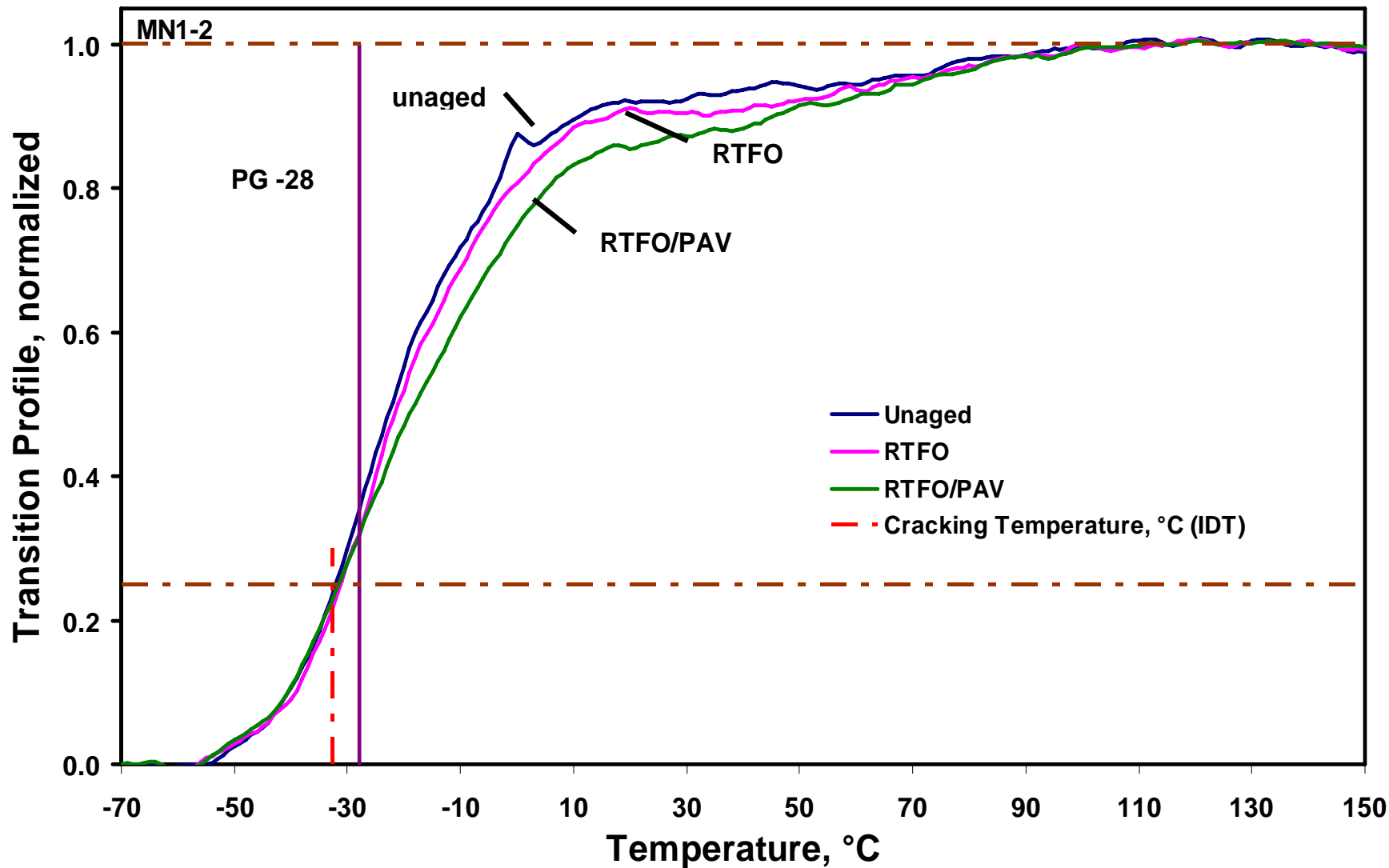
Glass Transition Profile



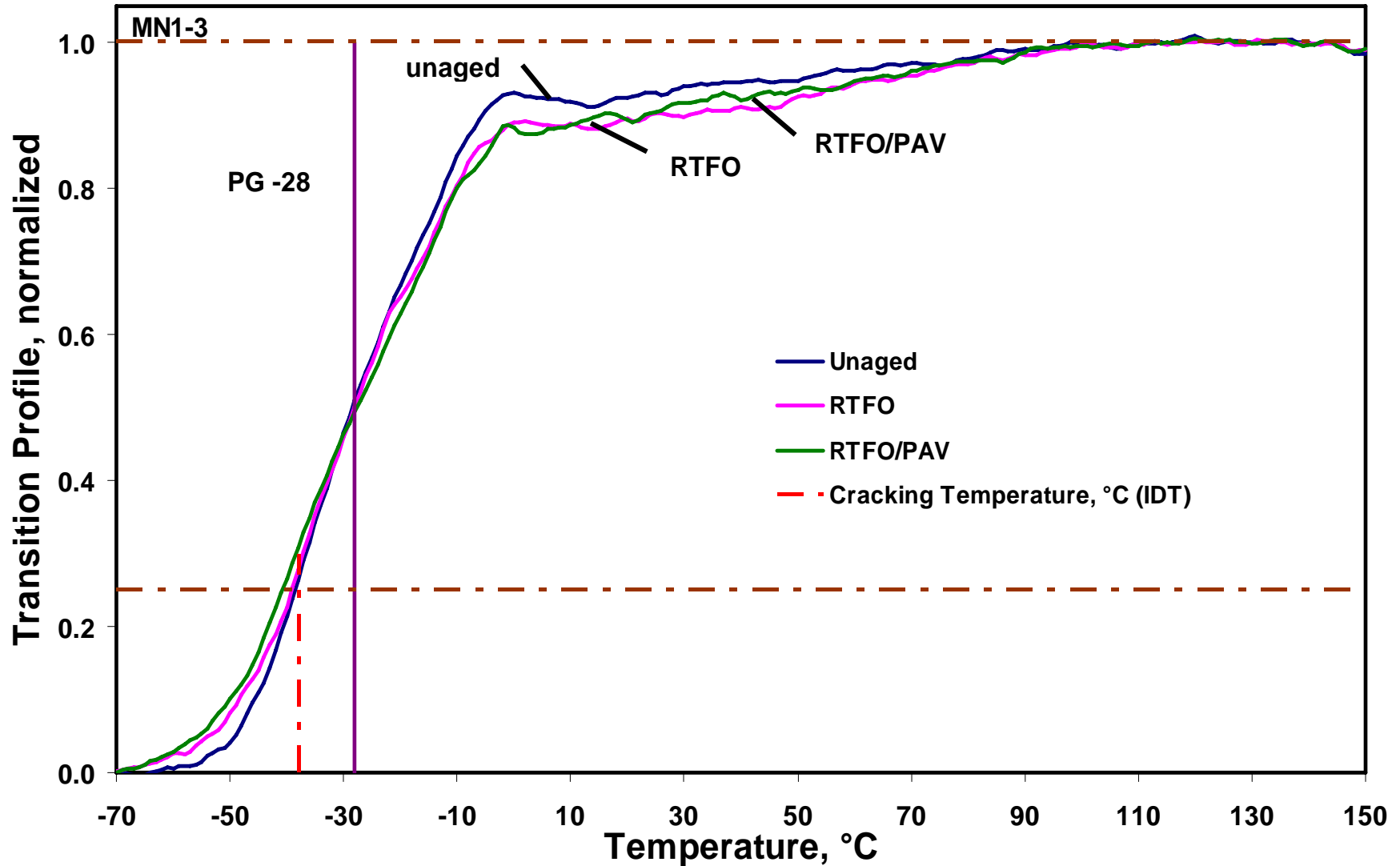
Glass Transition Profile (MN1-1)



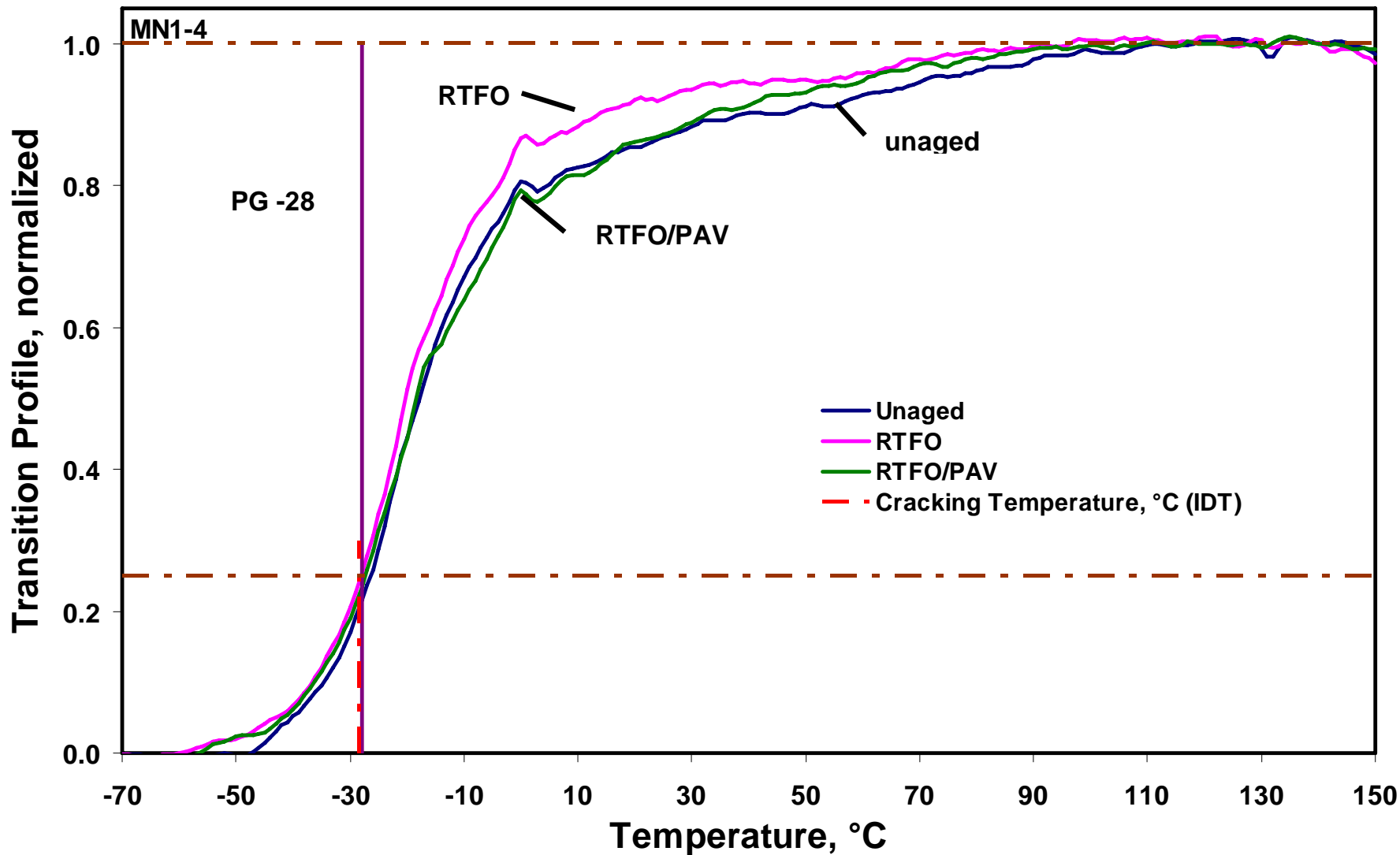
Glass Transition Profile (MN1-2)



Glass Transition Profile (MN1-3)



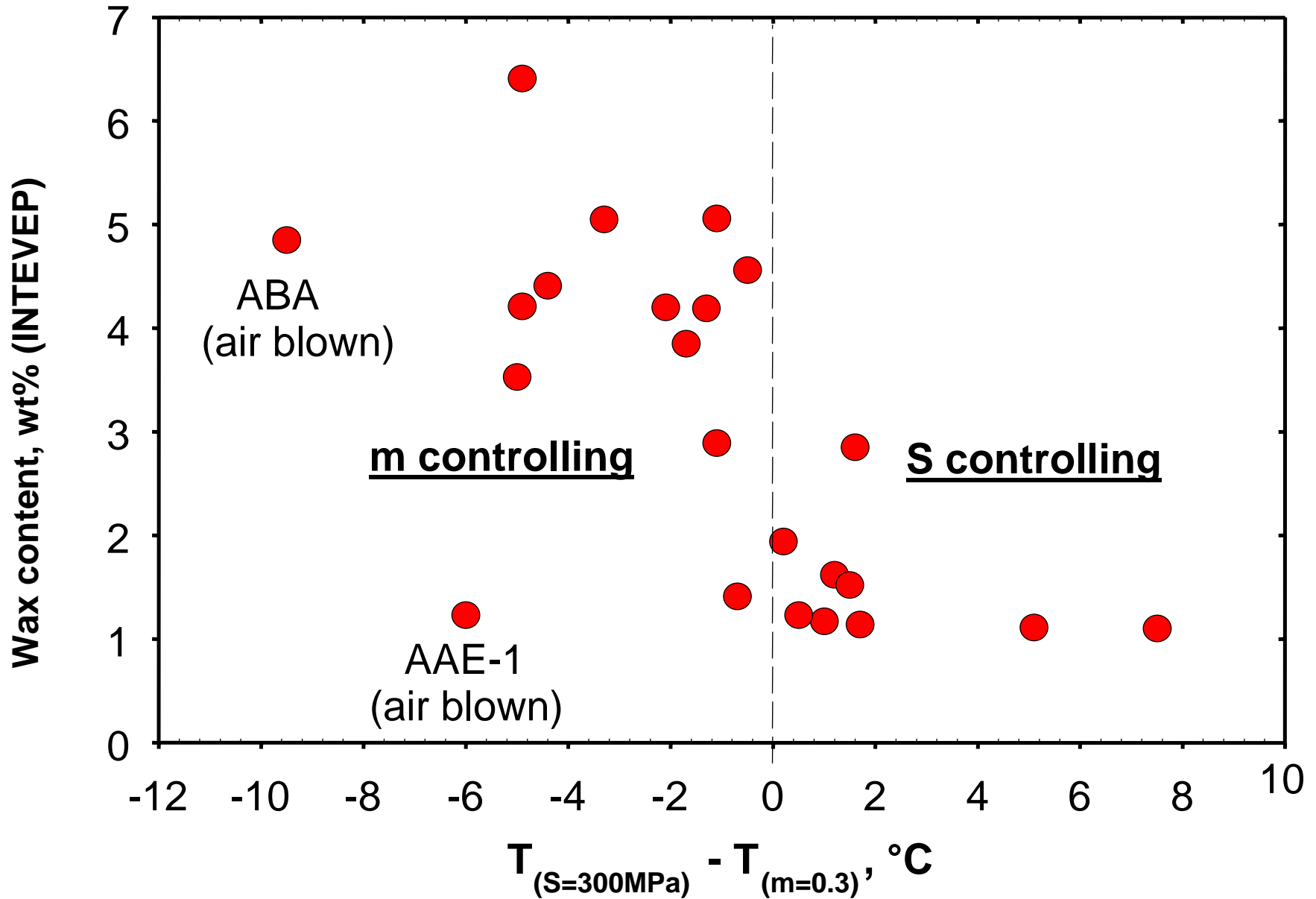
Glass Transition Profile (MN1-4)



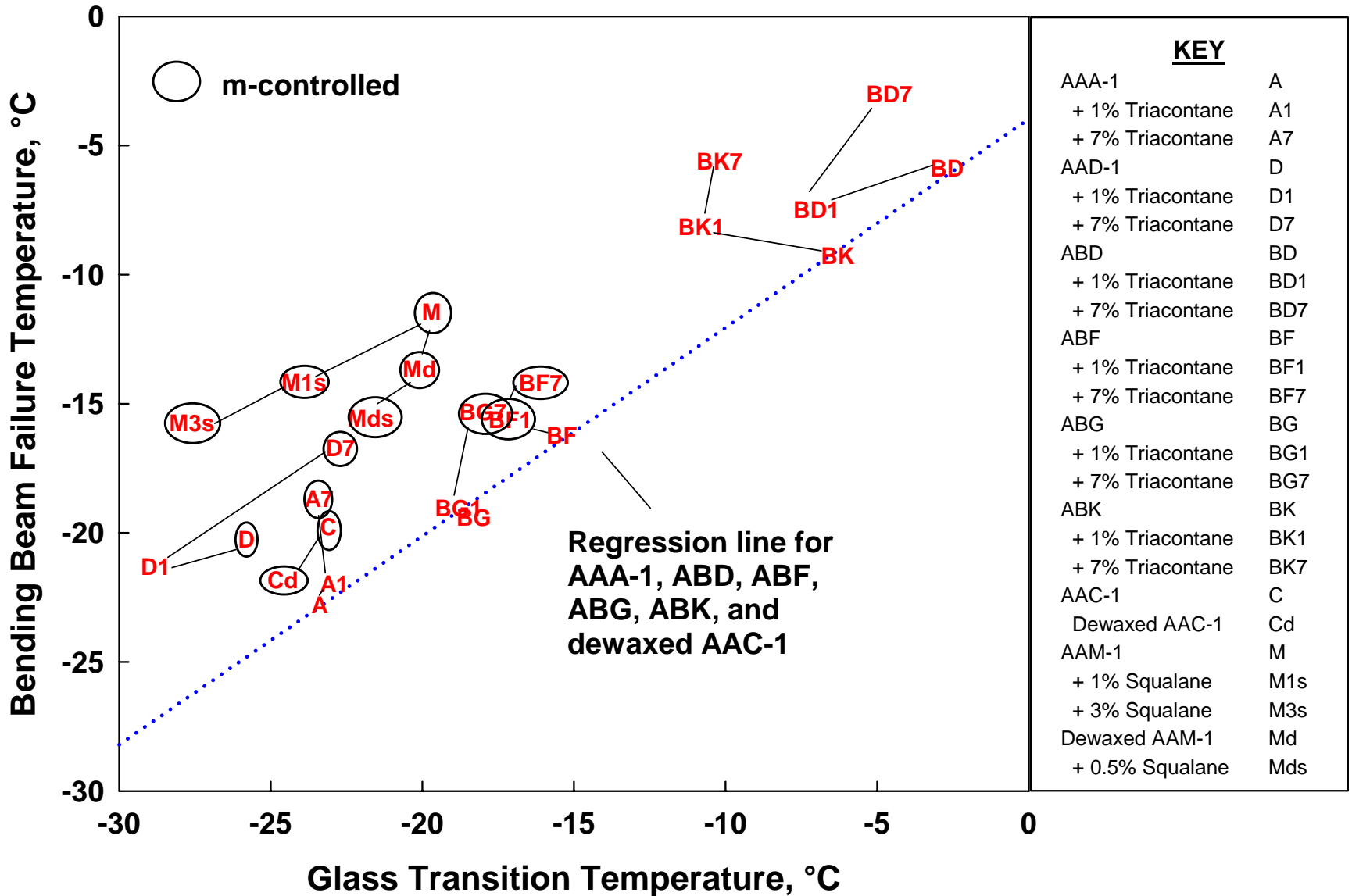
Questions?



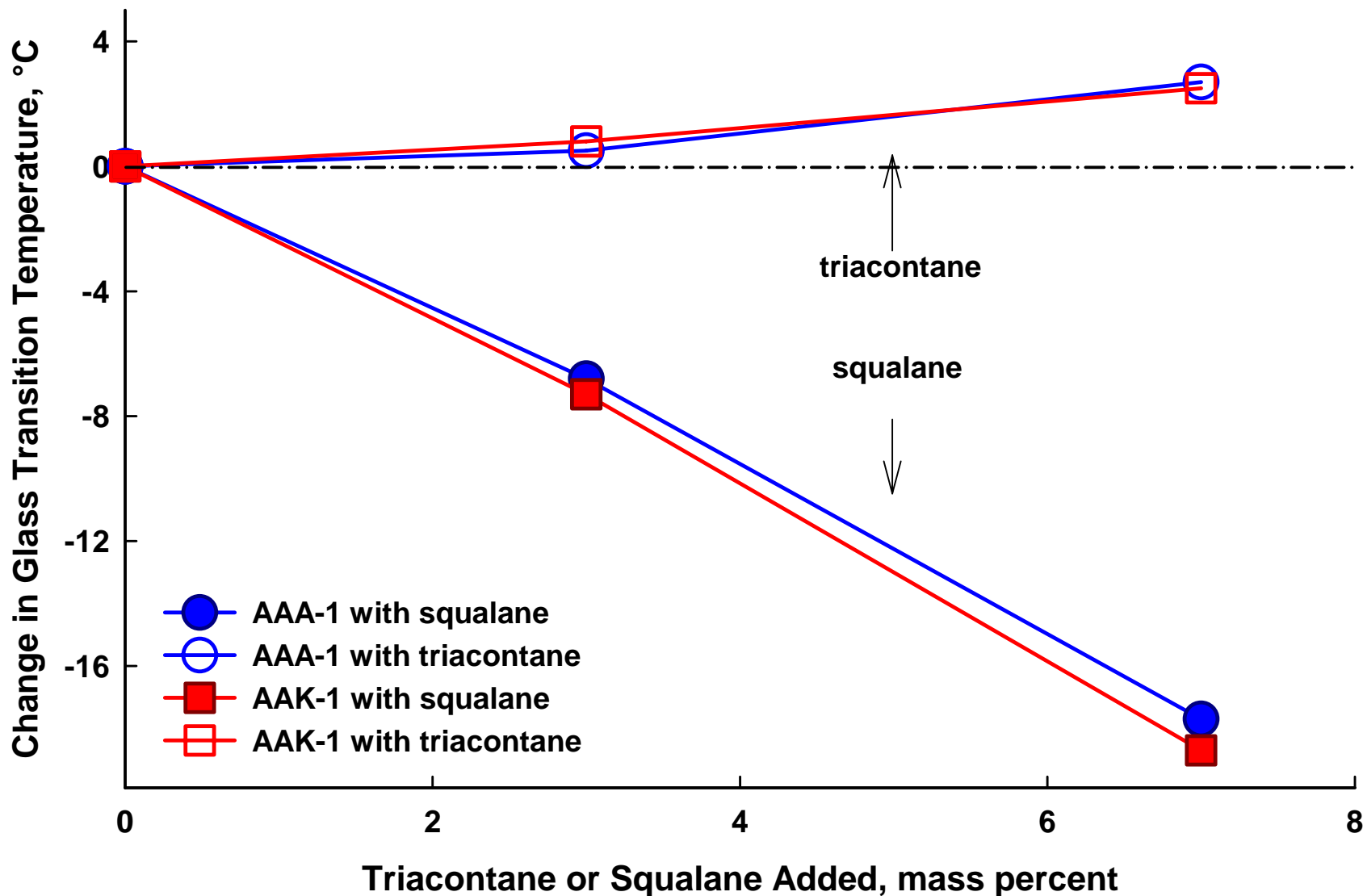
Internal Structure Influence on Low-T Spec.



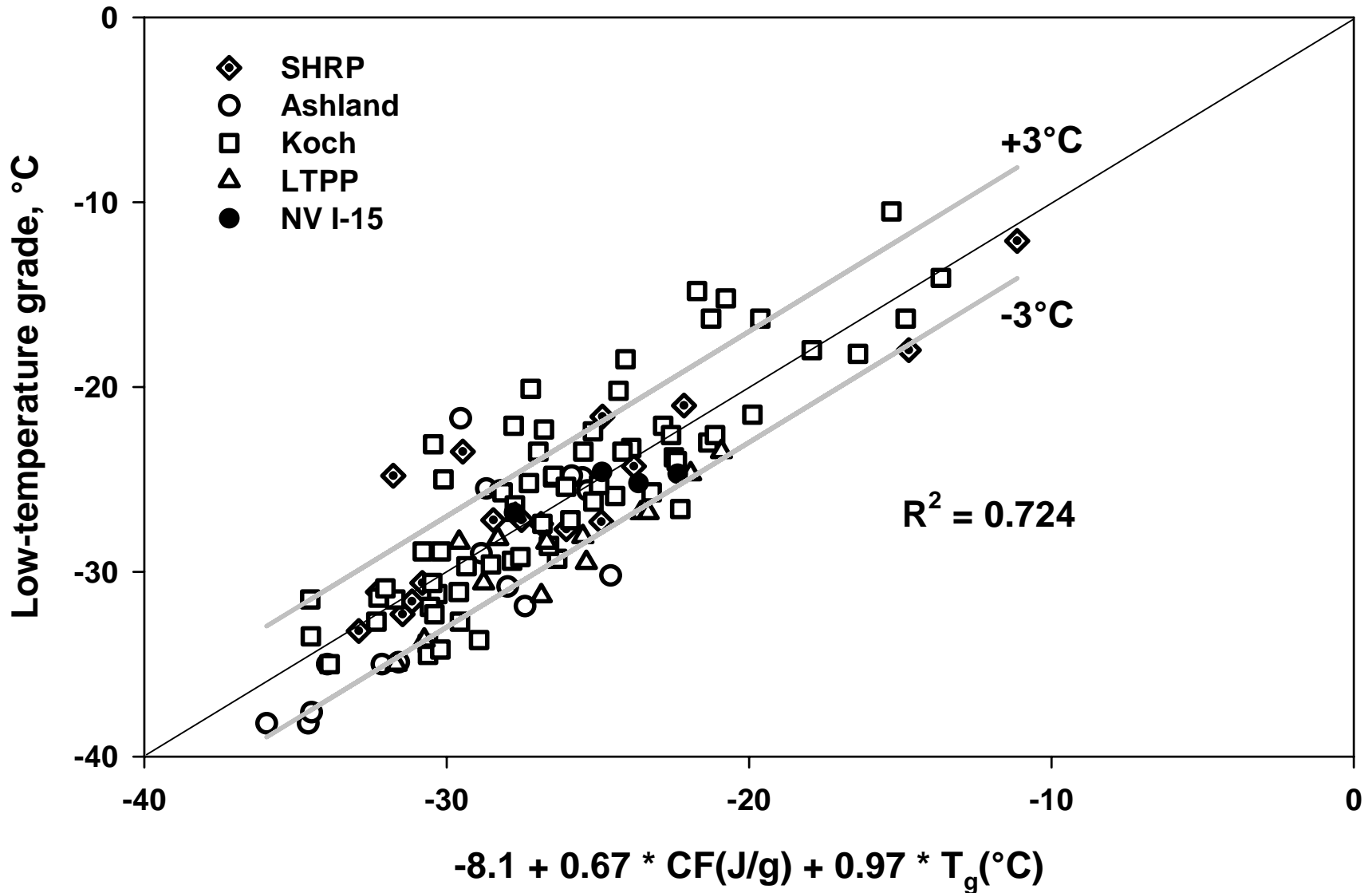
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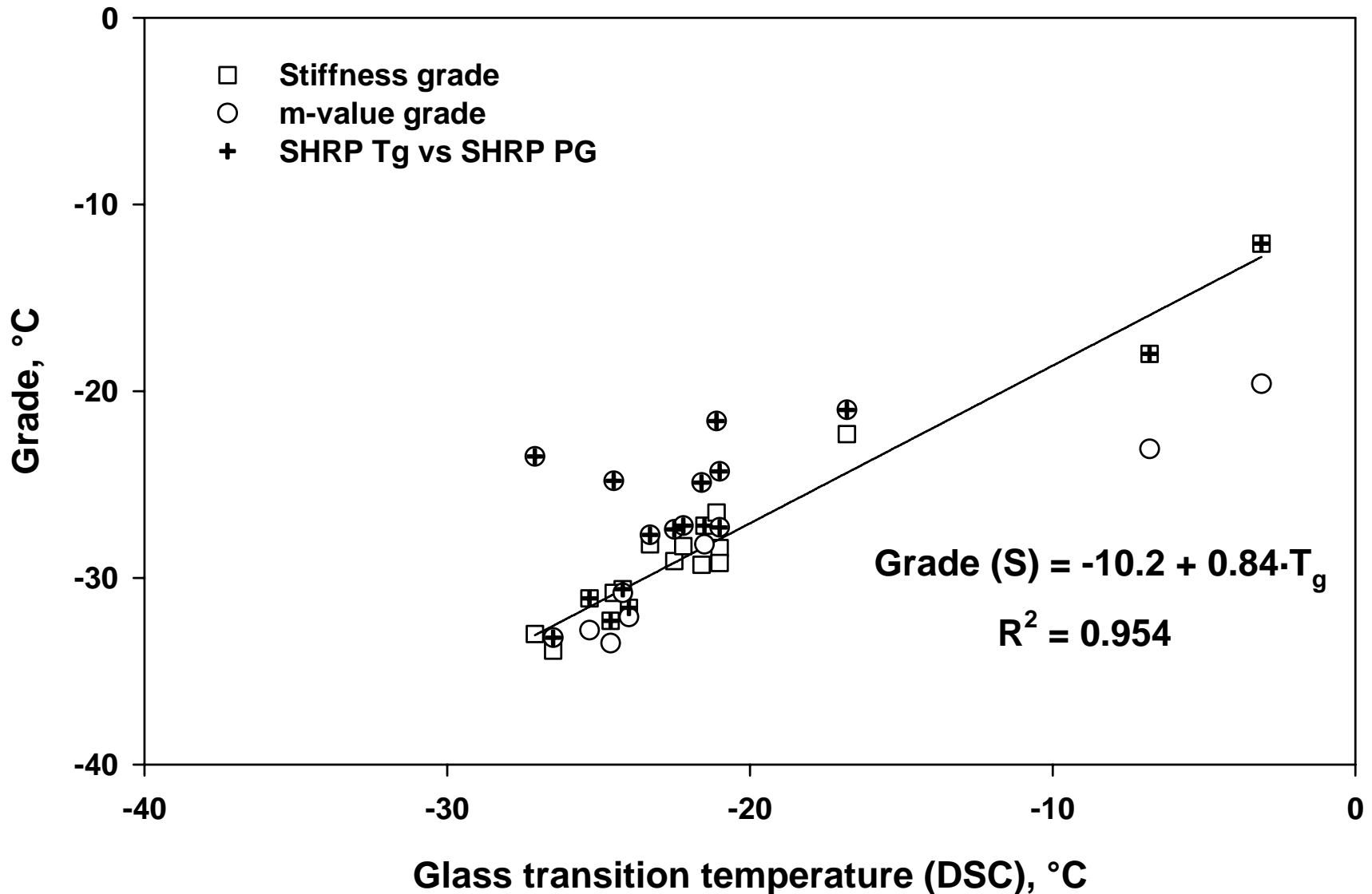
Influence of Linear and Branched Alkane Dopants



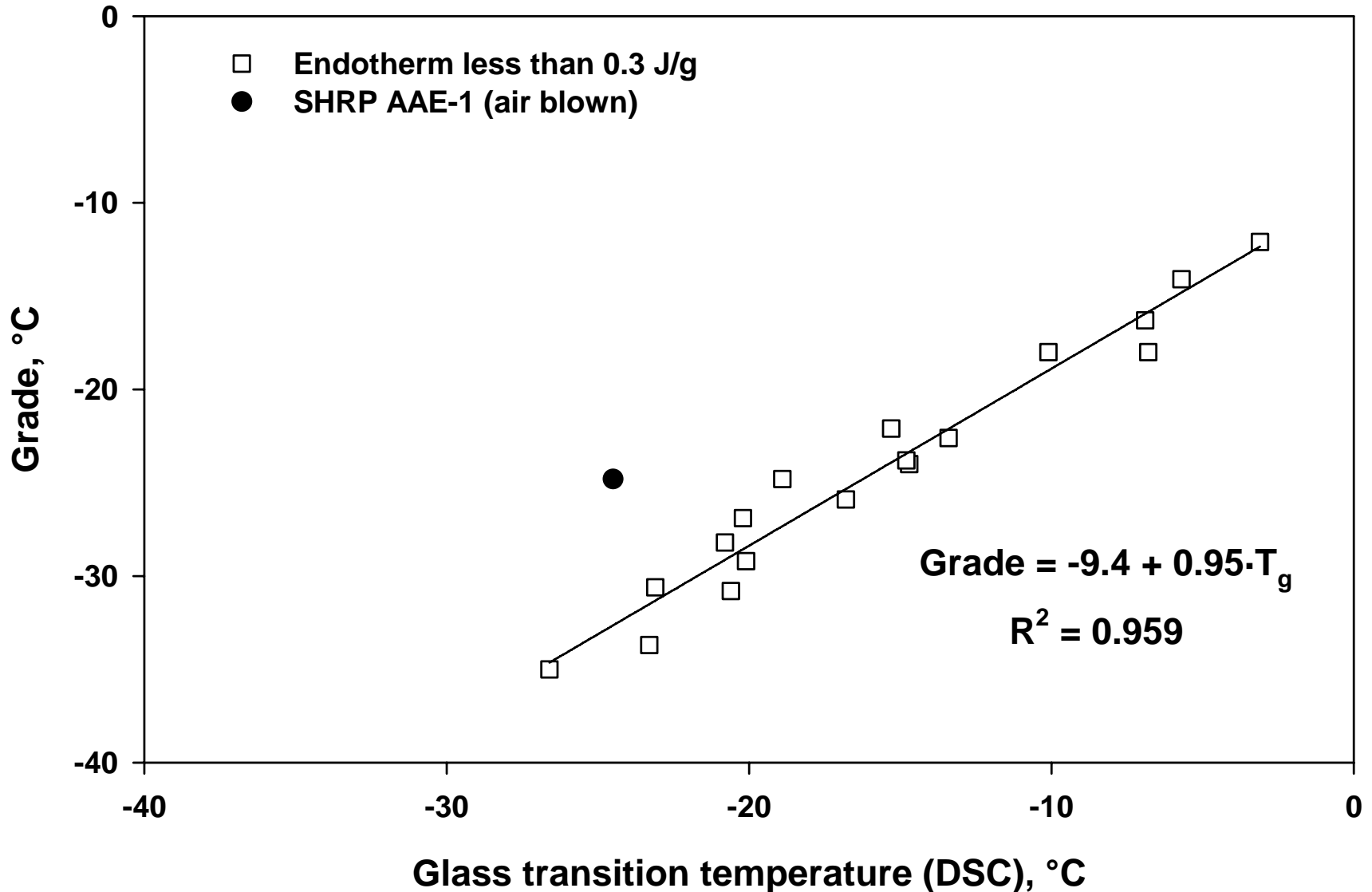
Low-T Grades of Commercial Asphalts



Low-T Grades of S-Controlled Asphalts



Low-T Grades of Low-Wax Asphalts



CF and Volumetric Expansion of Asphalt Above Tg

