Development of Standard Practice for Superpave Plus Specifications

Use of DSR in Place of ER and Ductility

John D'Angelo

Modified Binders Affect Performance

- Study same mix different binders.

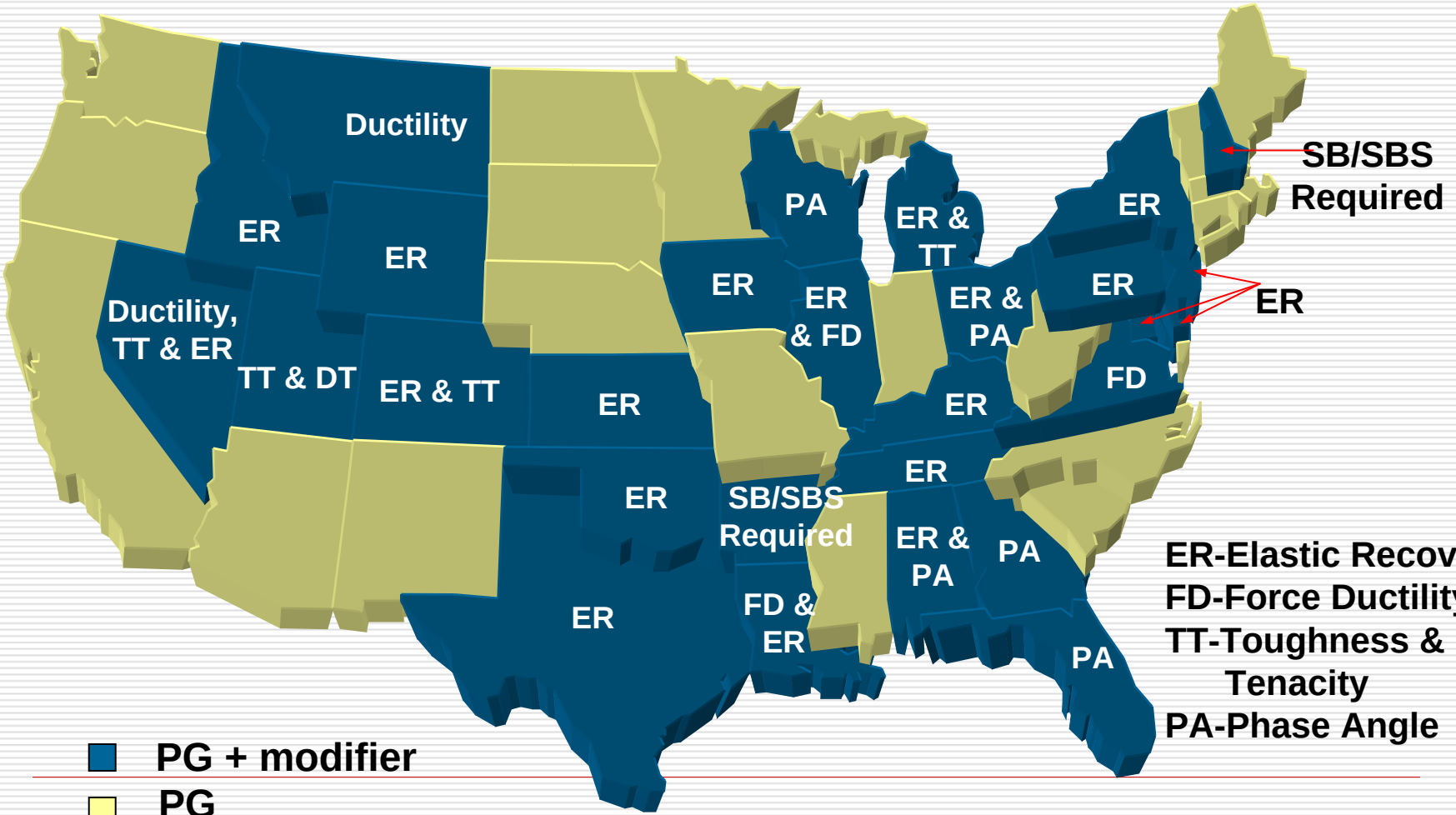
PG 63-22 mod. no rutting

PG 67-22 unmod. 15mm rutting

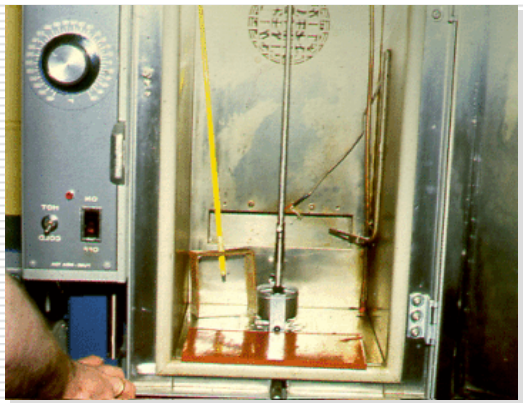
Why Superpave Plus Specs.

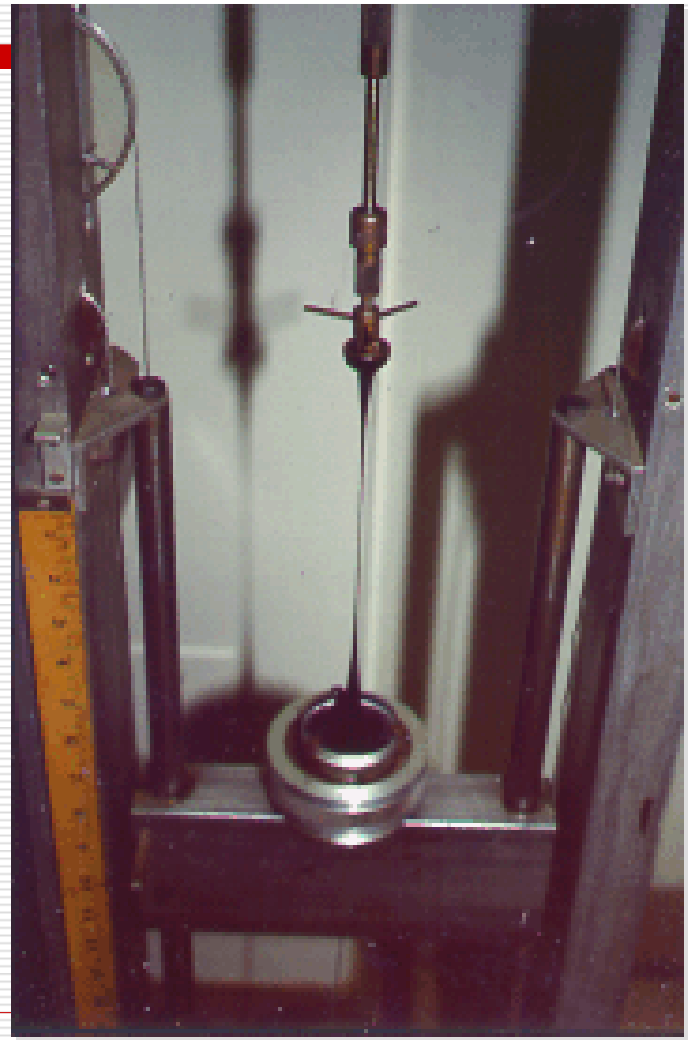
- The existing specifications do not identify the performance characteristics of modified binders.
- The existing specifications do not have a criteria for fatigue or durability.
- Agencies look to other tests to identify modifiers
  - Elastomeric polymer modifiers are desired

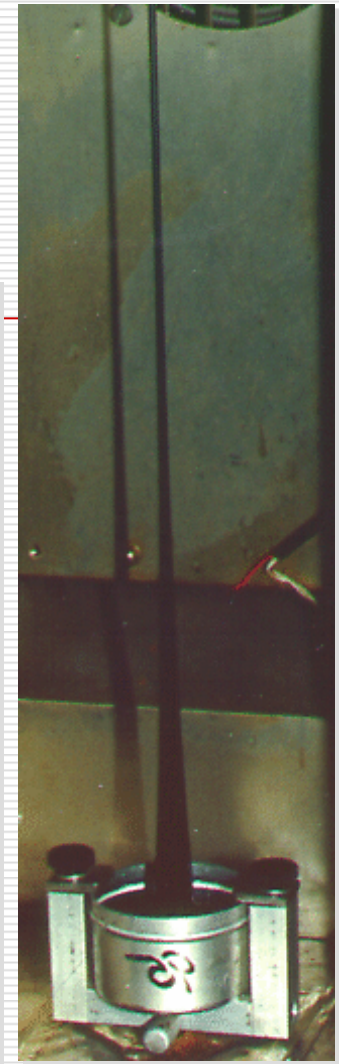
State DOT's Specifying Polymer PG (PG+)



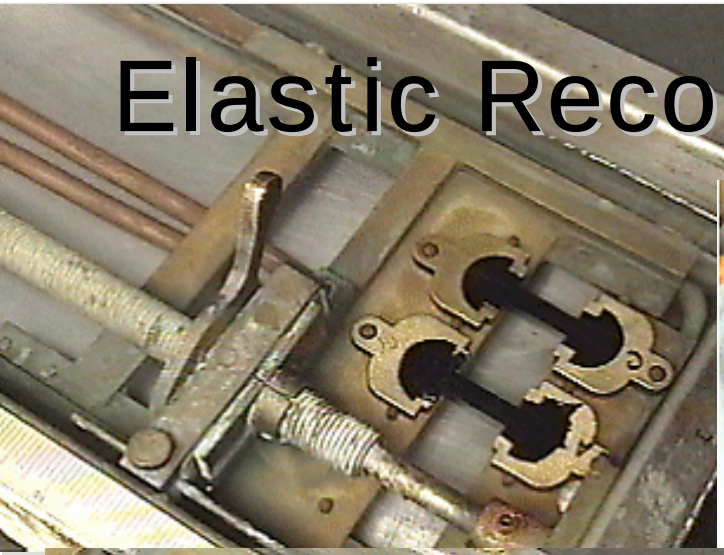
Toughness & Tenacity

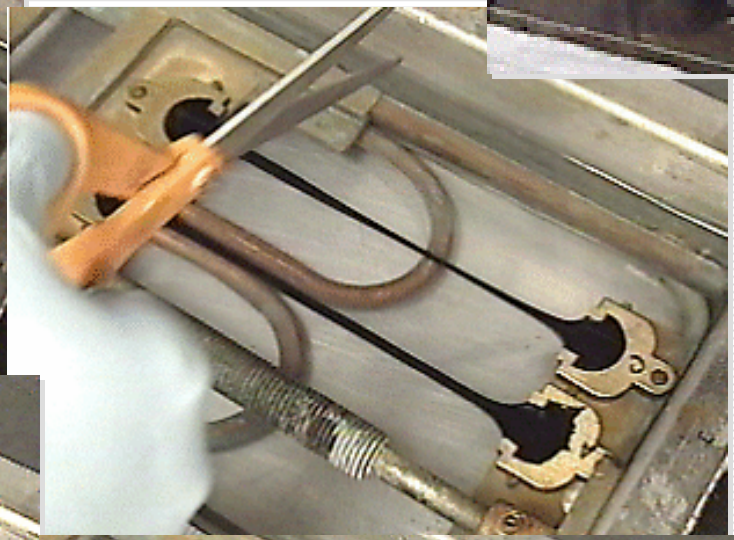


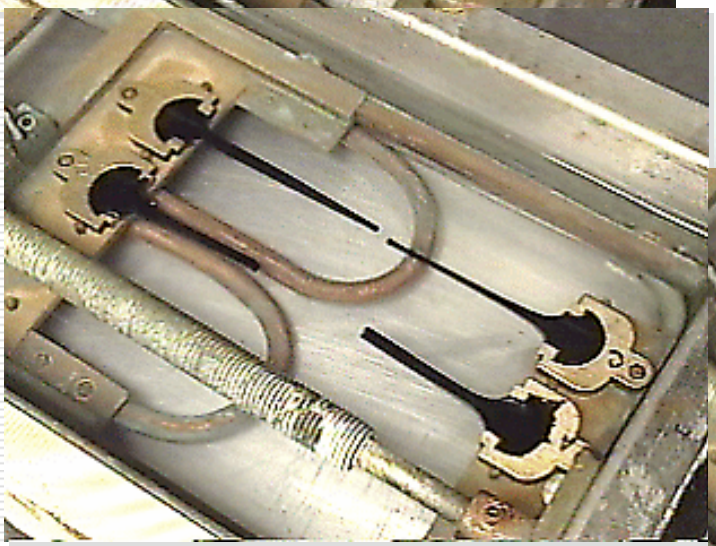


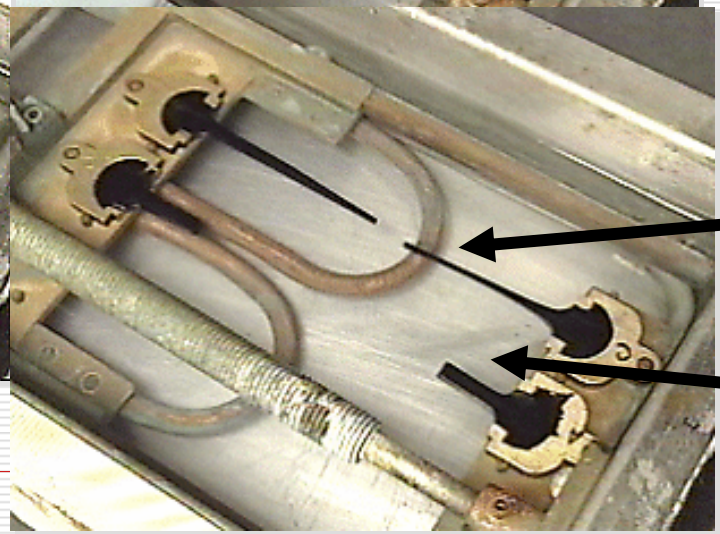


Elastic Recovery









AC doesn't recover

SB modified AC recovers

“Any type of PG+ spec needs to be unified throughout the country or at least a region. Plus specs are being added by individual states with little or no justification. Research has already moved on without adequate evaluation of existing specs (M-320 & MP-1A).”

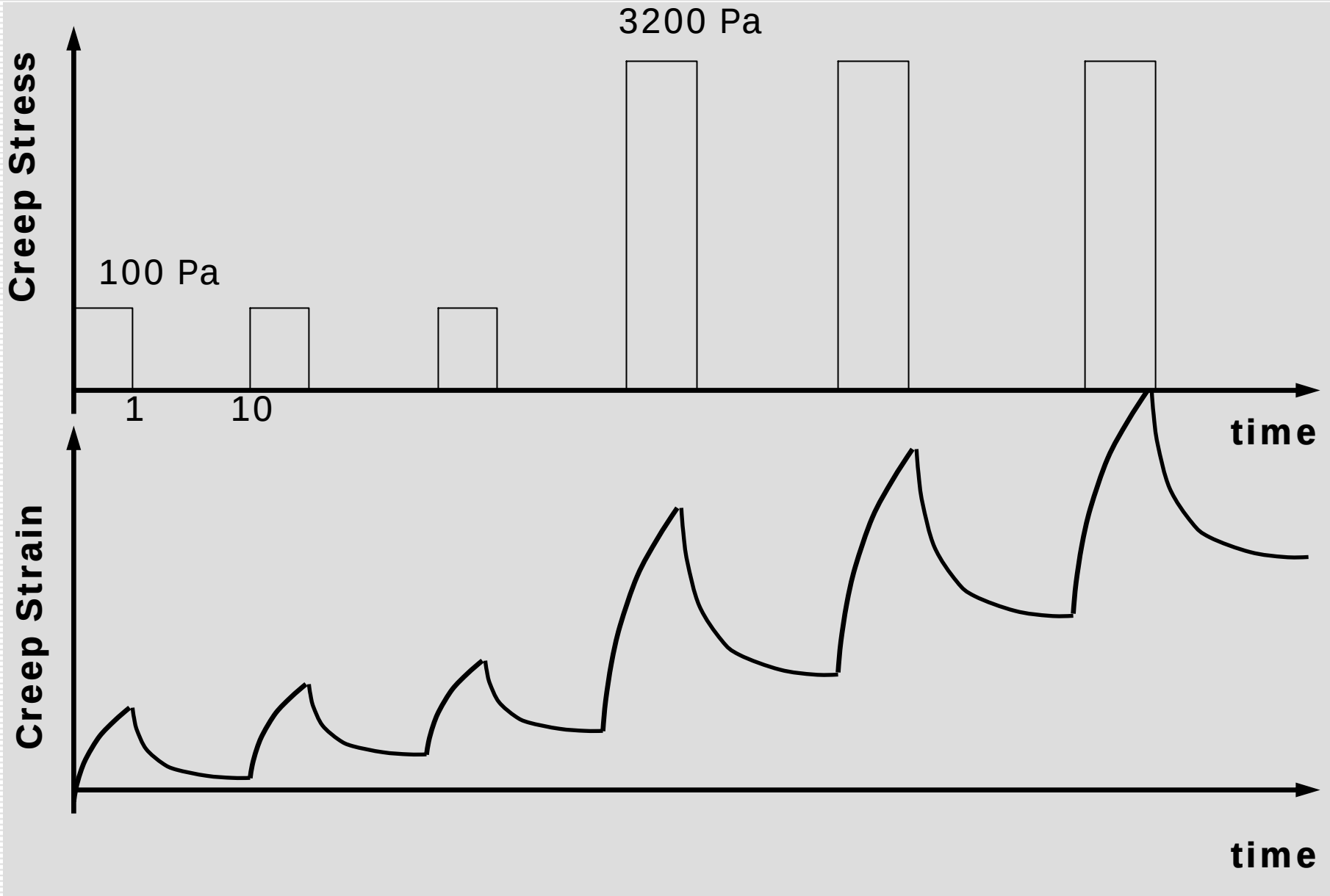
Problem Statement

- Provide Users with alternatives to the empirical Superpave Plus tests
  - Elastic Recovery
  - Ductility/ Force Ductility
  - Toughness and Tenacity
- Approach: Develop AASHTO/ASTM Standard Practice for Superpave Plus Specifications
  - DSR
    - Multiple Stress Creep Recovery

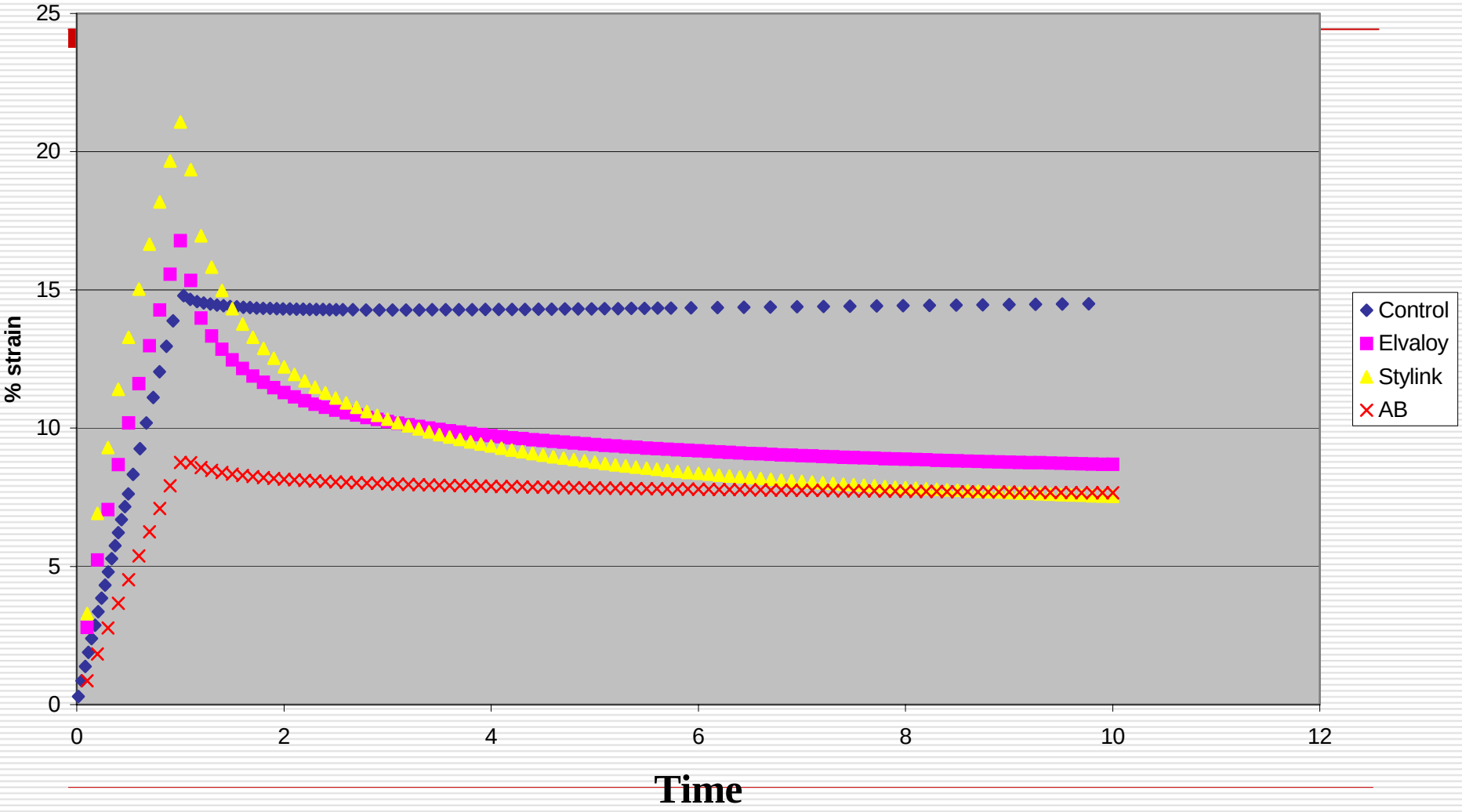
So What Do We Do? – Use DSR Approach

- Use DSR
  - Muti Stress Creep Recovery Test
    - One or two creep stress levels
    - Four to ten cycles per stress level
    - For Elastomeric modifiers Specify:
      - % strain recovery > 15%

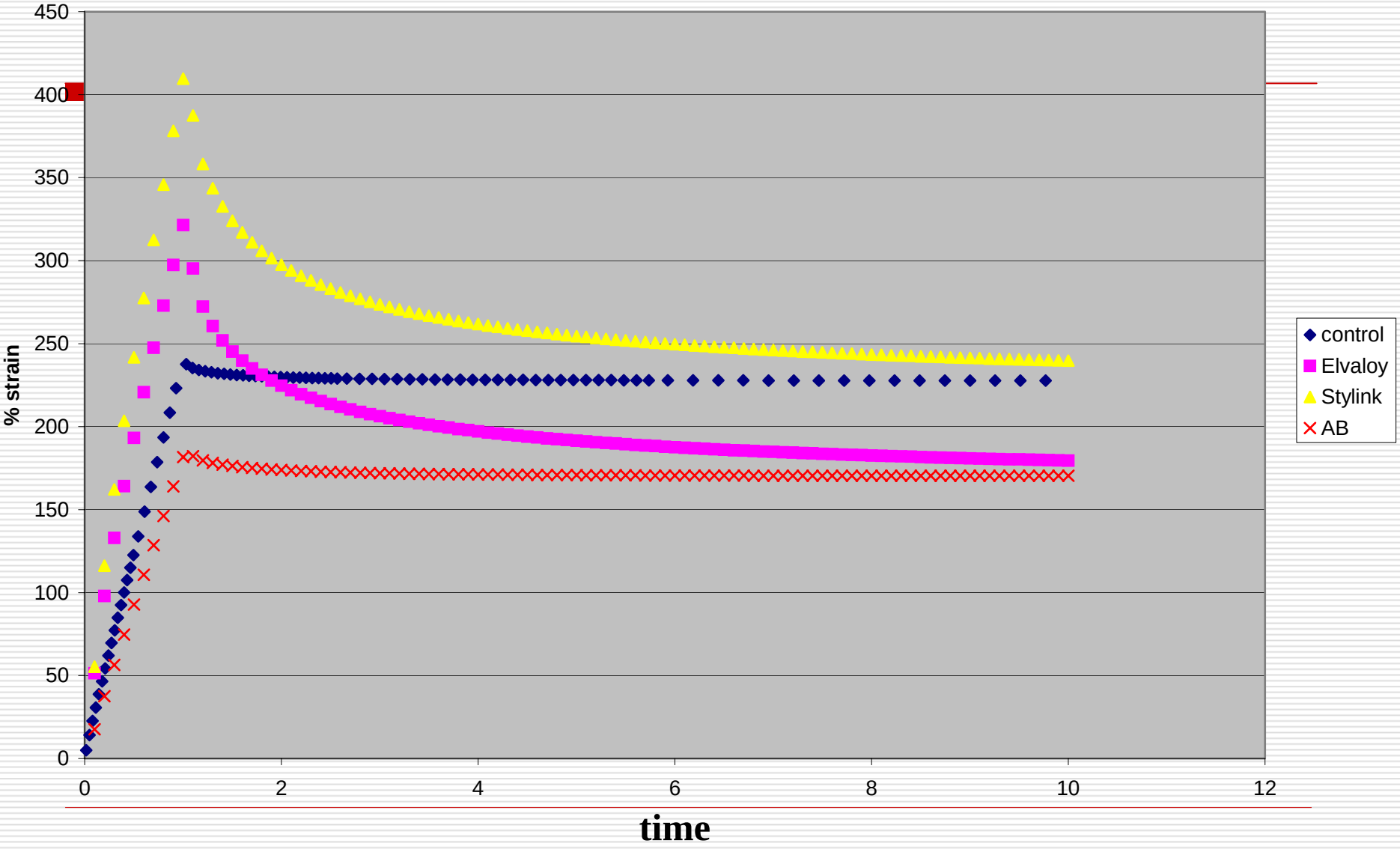
Proposed MSCR TEST Protocol

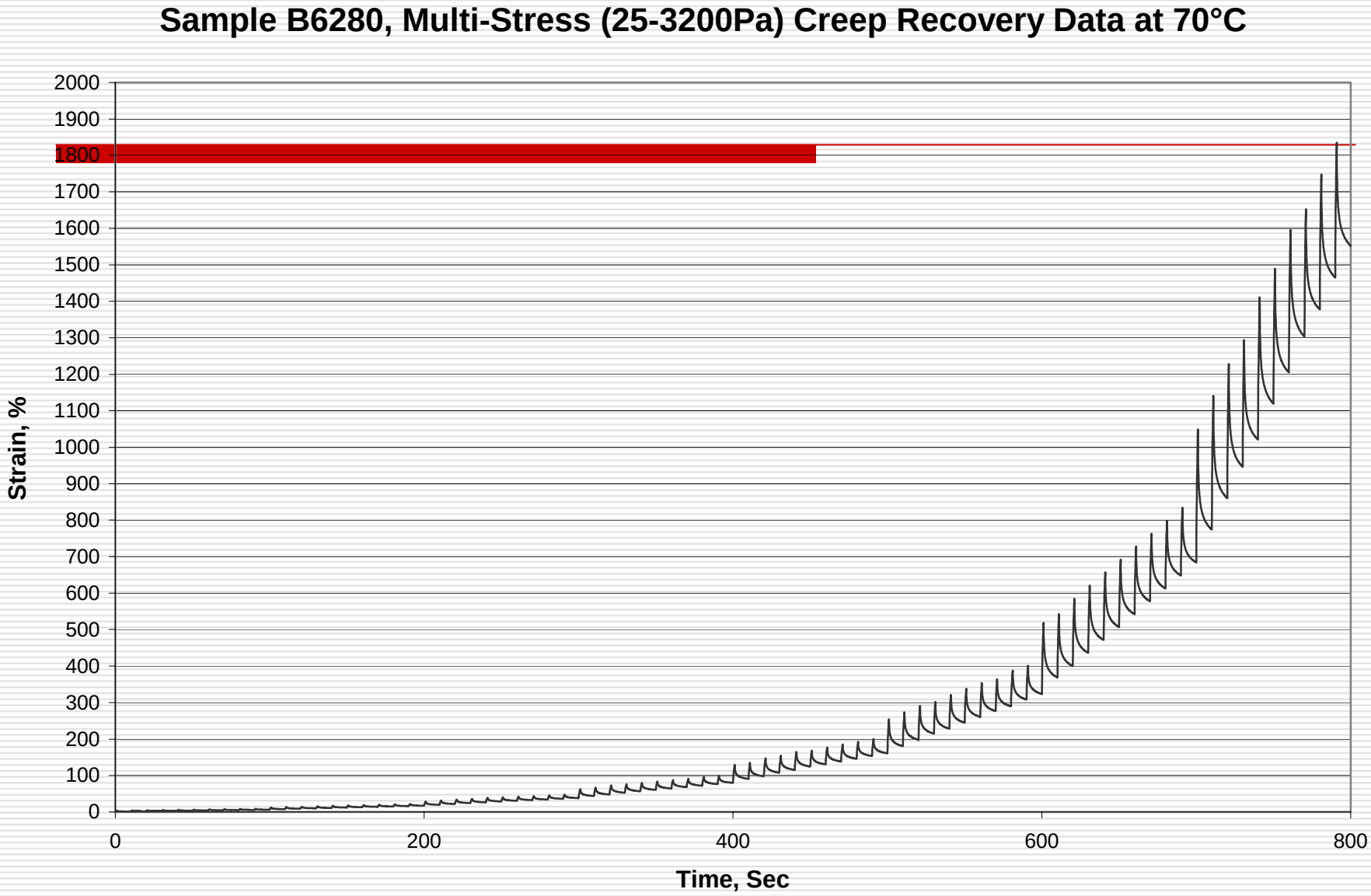


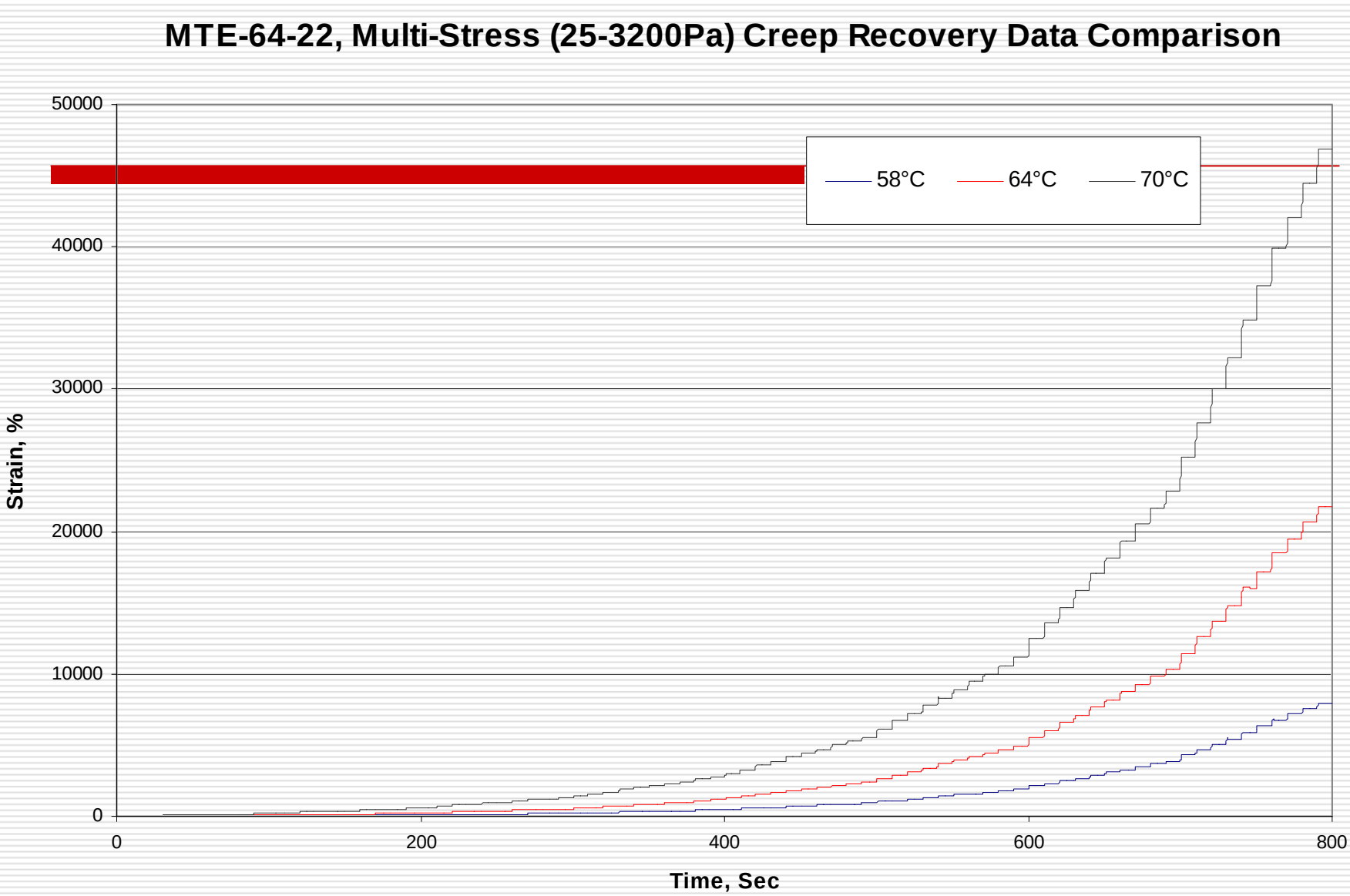
Creep 1st cycle 70C 50 Pa



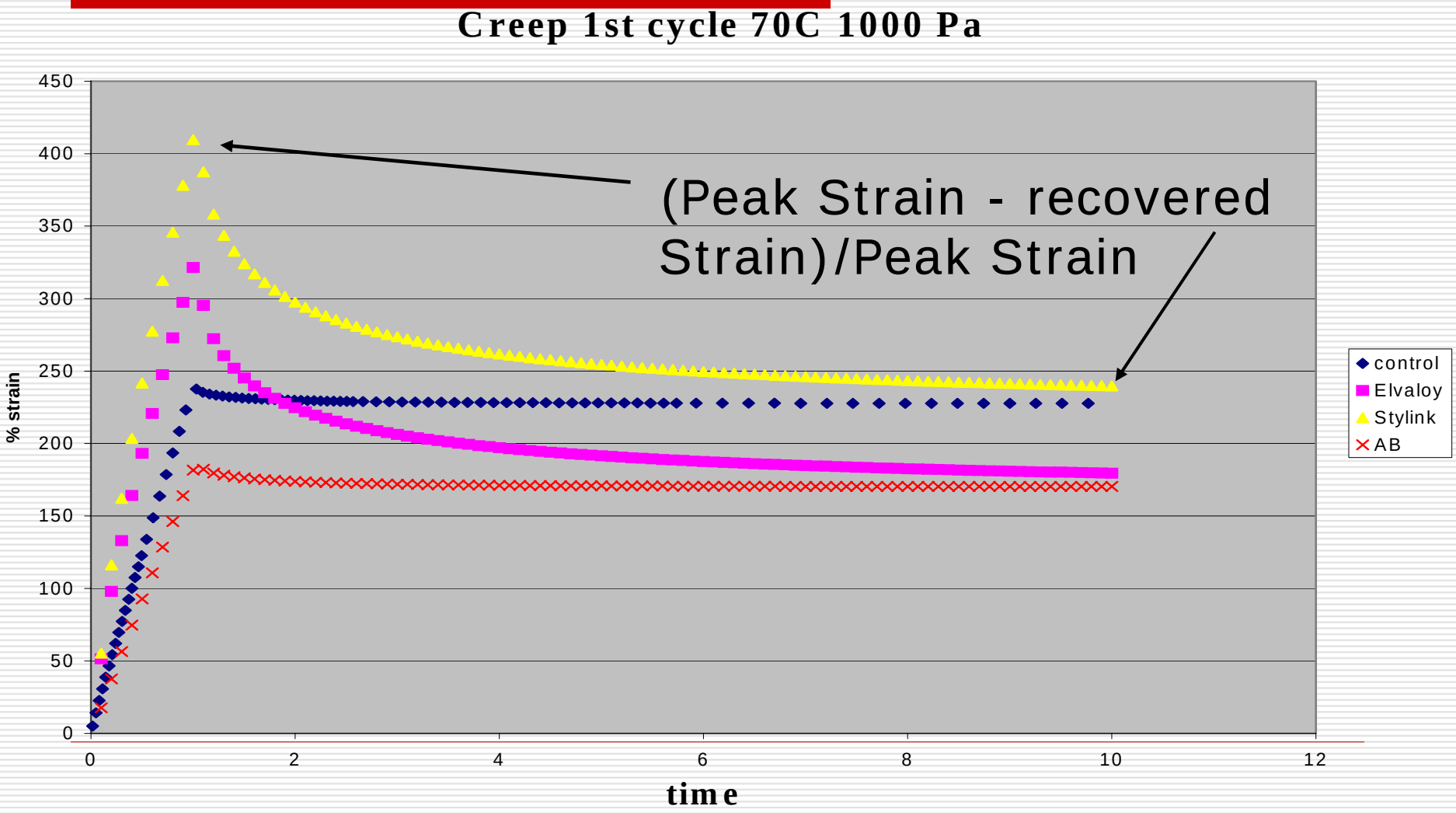
Creep 1st cycle 70C 1000 Pa



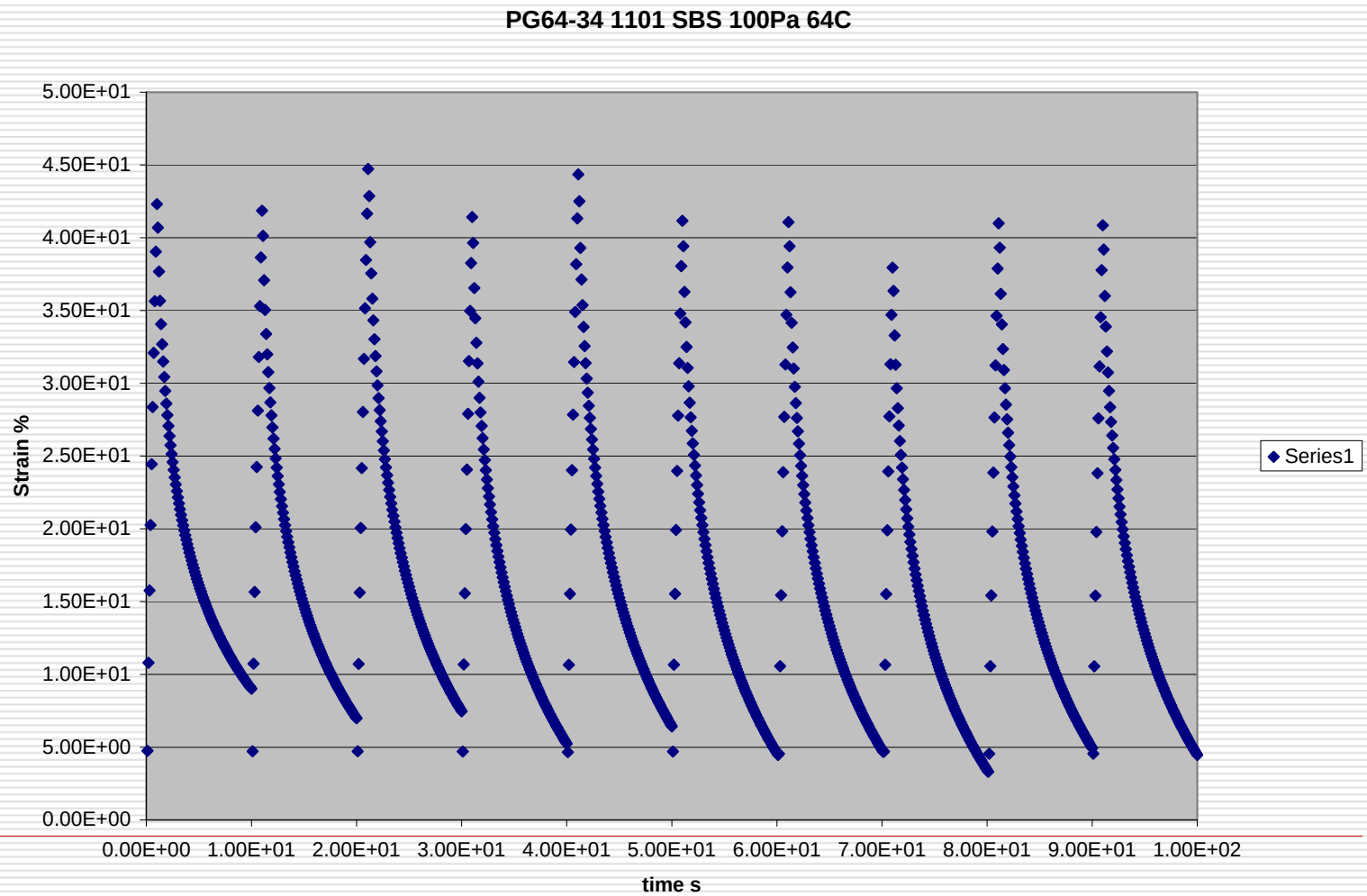

Sample B6280, Multi-Stress (25-3200Pa) Creep Recovery Data at 70°C
Strain, %
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0
200
400
600
800
Time, Sec


MTE-64-22, Multi-Stress (25-3200Pa) Creep Recovery Data Comparison
50000
40000
30000
20000
10000
0
Strain, %
58°C
64°C
70°C
0
200
400
600
800
Time, Sec

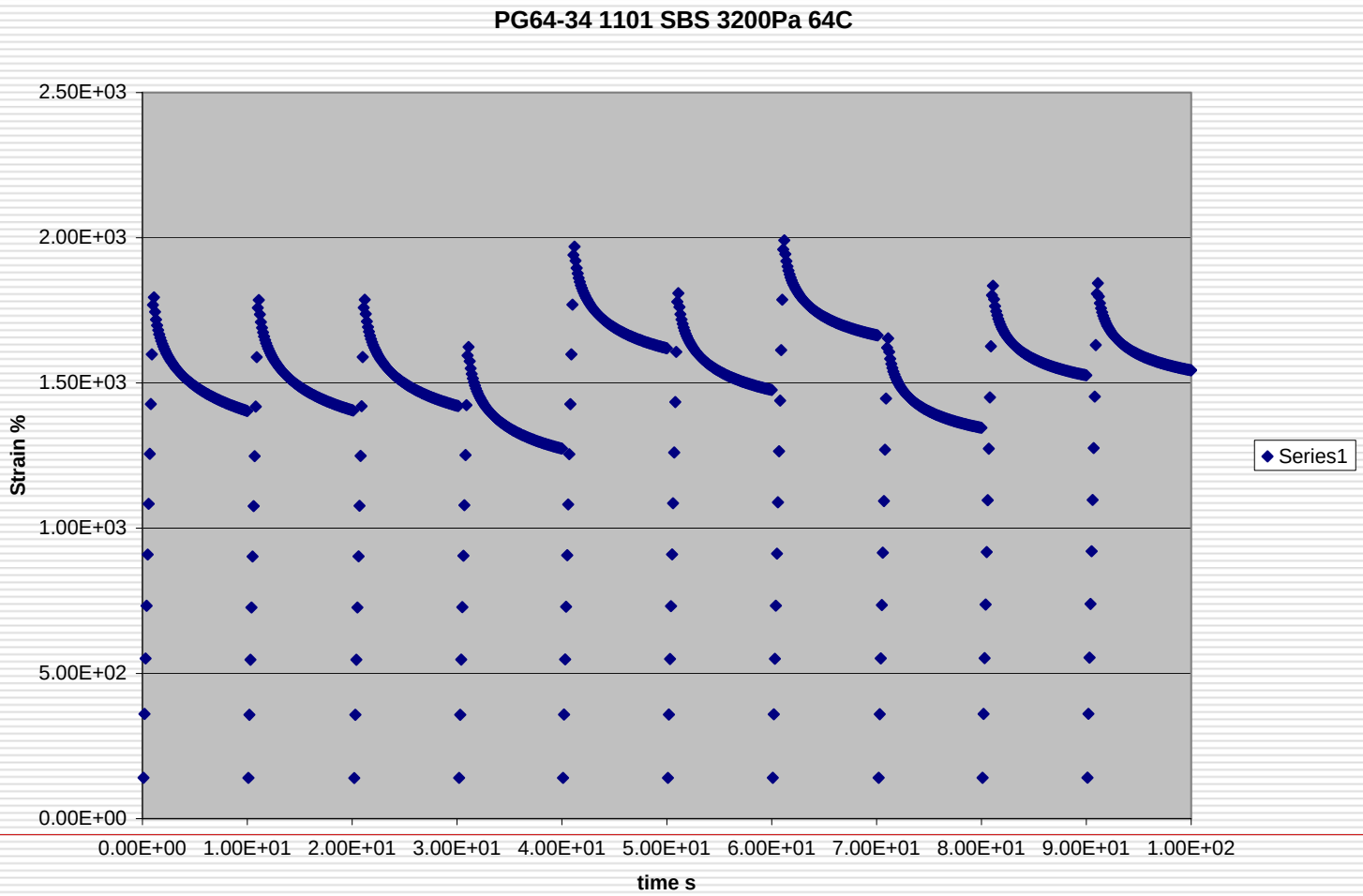
What criteria? % recovered strain



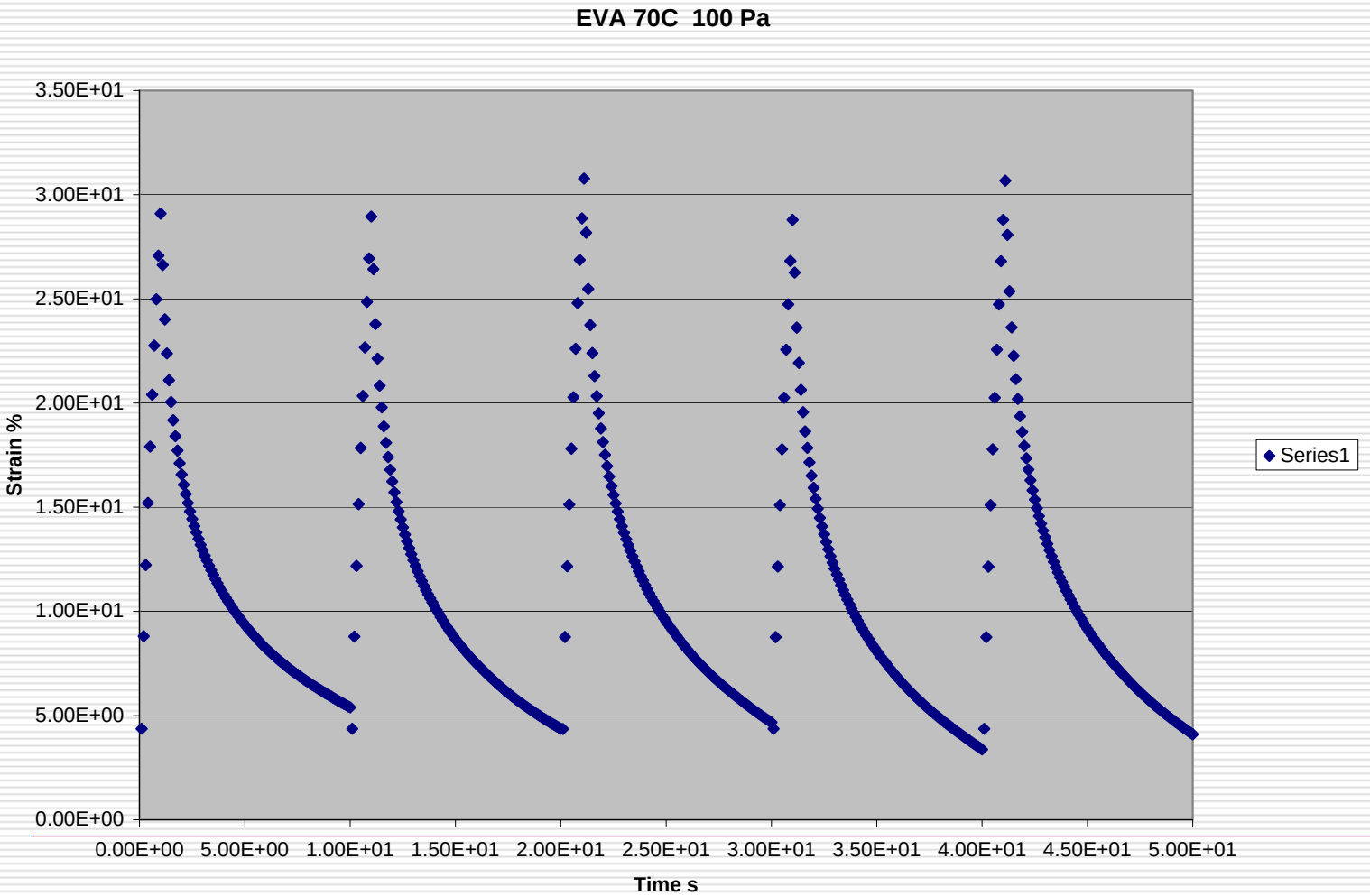
PG 64-34 1101 SBS 83% recovery 100Pa



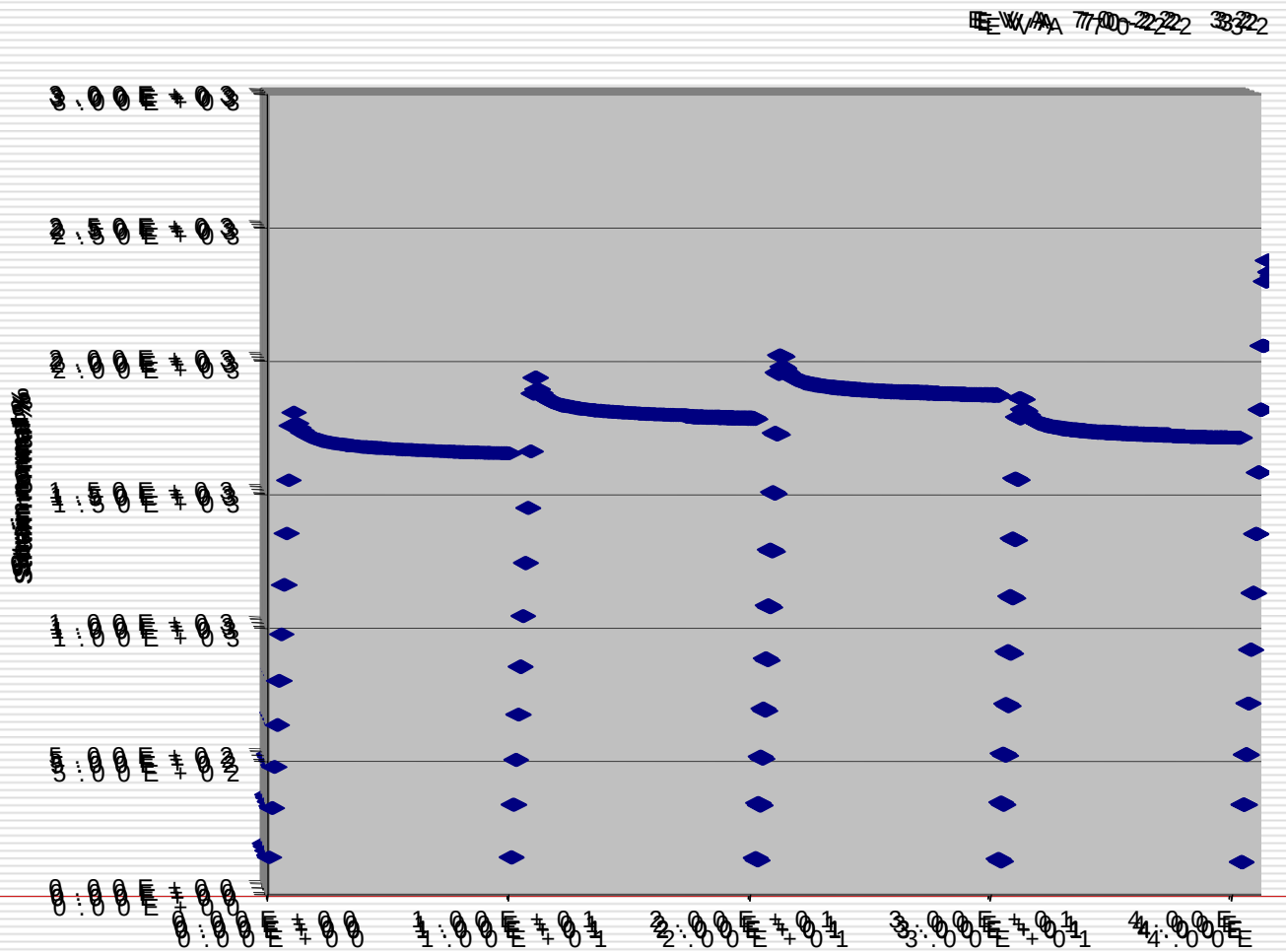
PG 64-34 1101 SBS 21% recovery 3200Pa



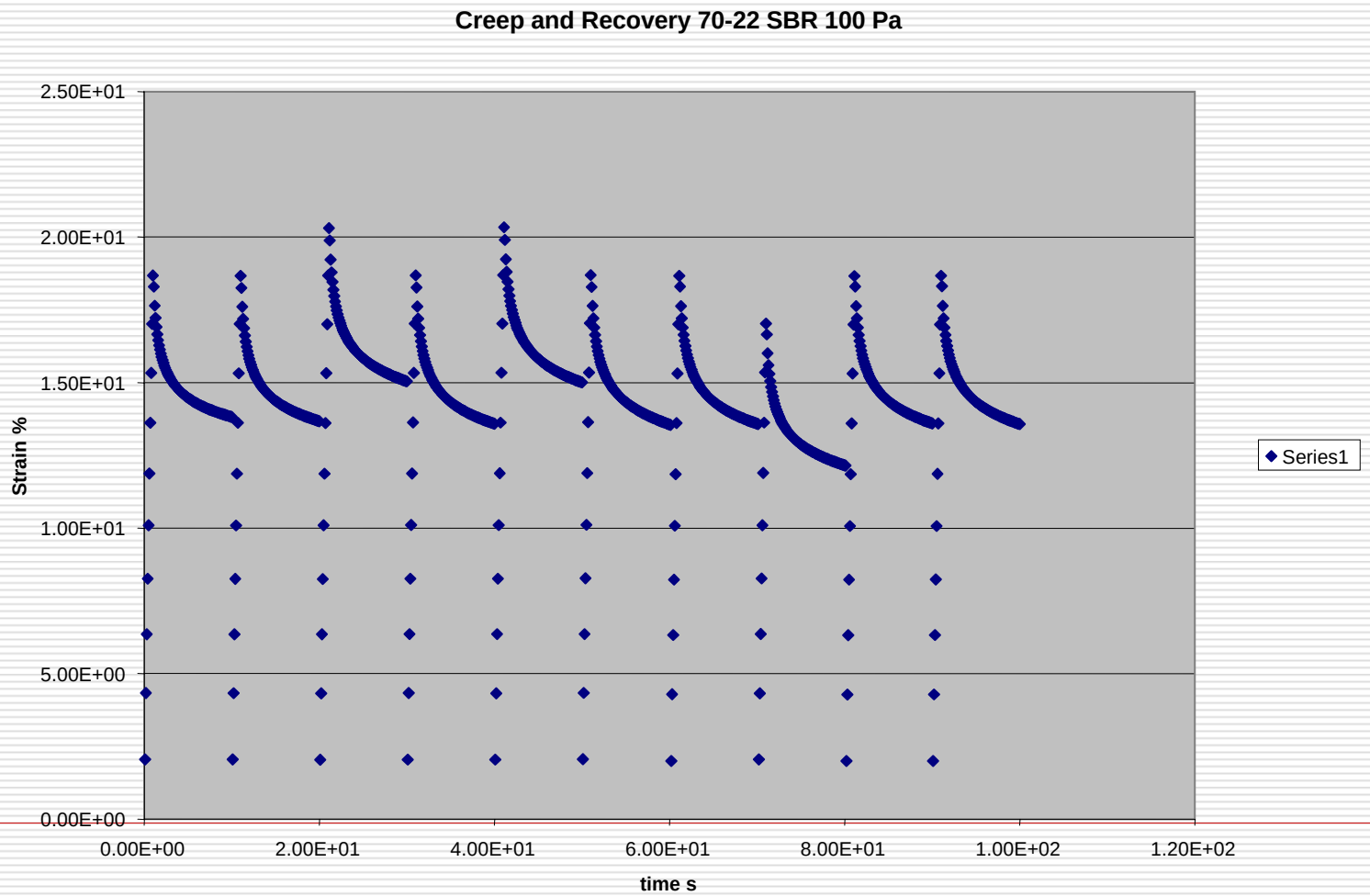
70-22 EVA 81% recovery 100Pa



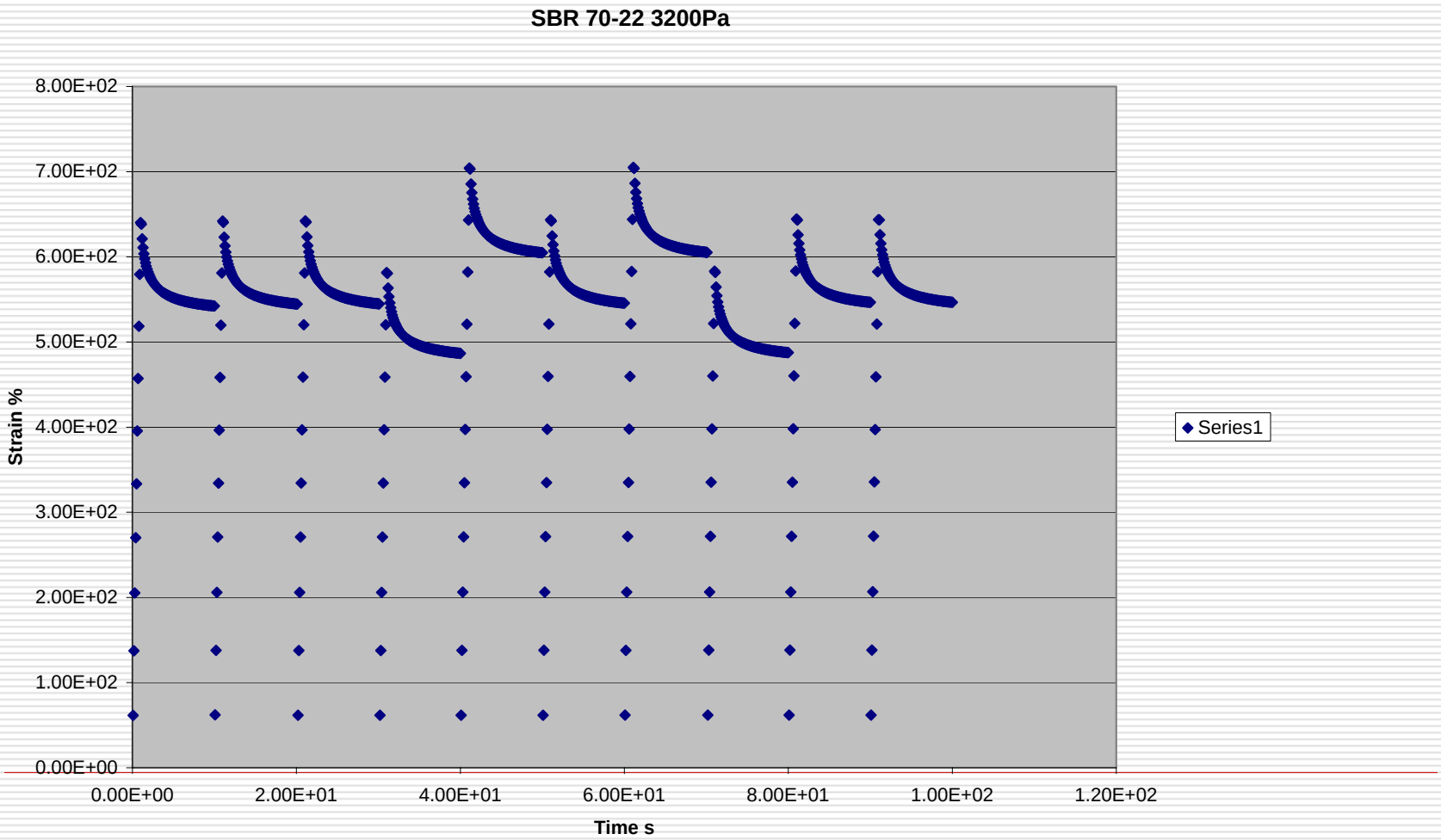
70-22 EVA 8% recovery 3200Pa



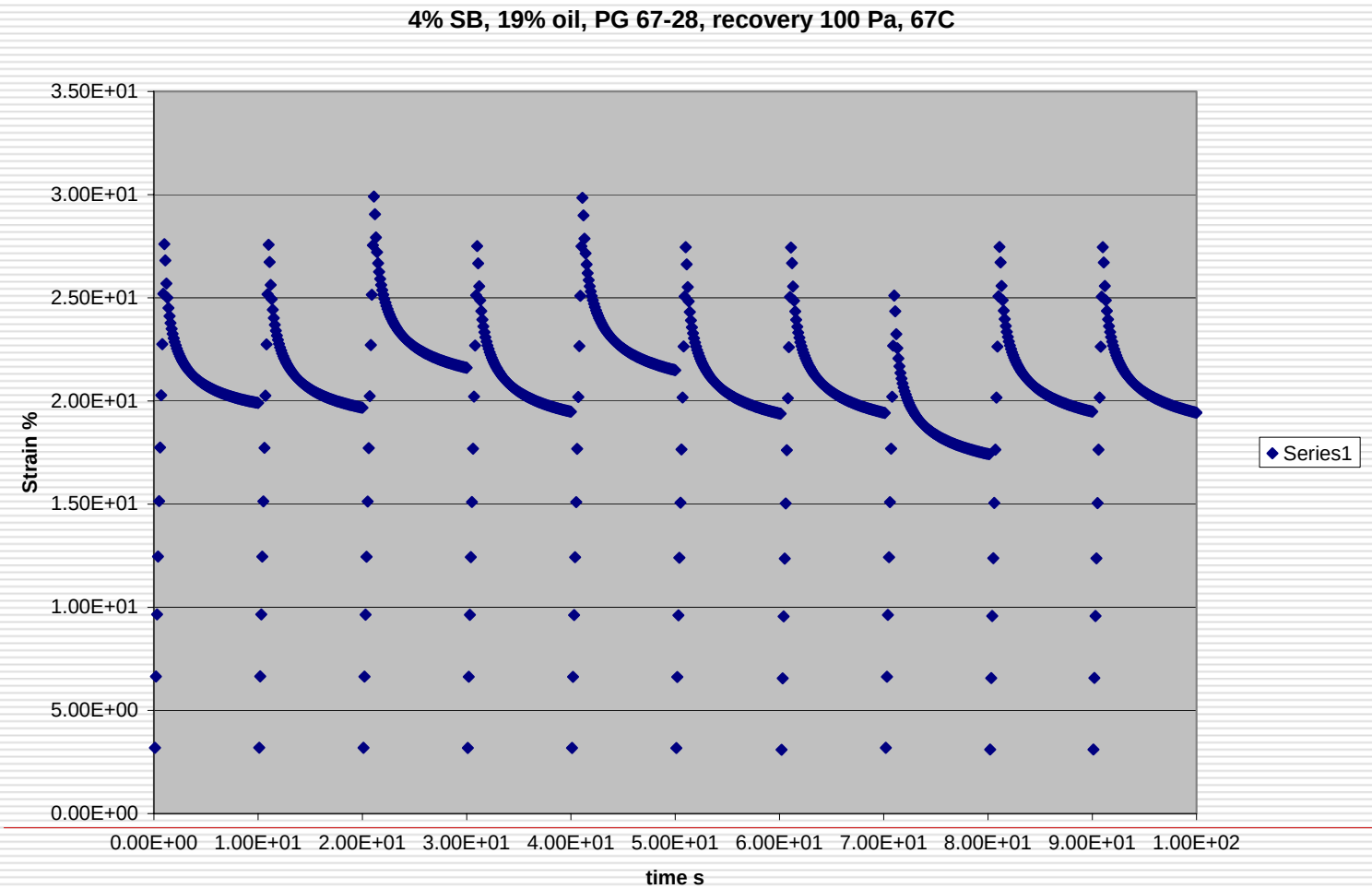
70-22 3%SBR 26% recovery 100Pa



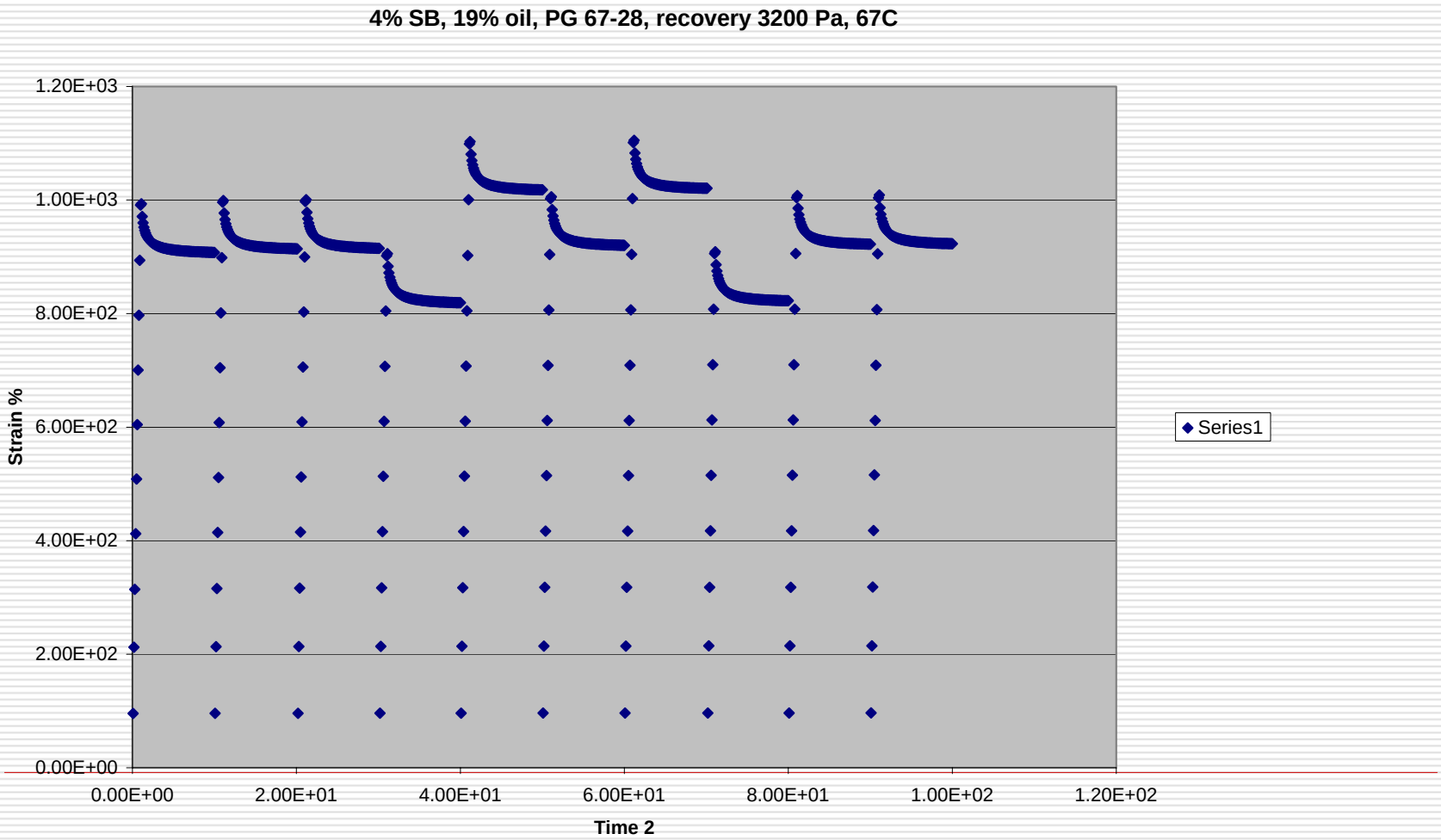
70-22 3%SBR 15% recovery 3200Pa



67-28 28% recovery 100Pa



67-28 9% recovery 3200Pa



Findings to date

- The DSR MSCR percent strain recovery criterion can replace the FD, ER, or T&T.

Future Steps

- Analyze available MSCR percent recovered strain data to finalize creep stress level and test protocol
- Where available, show relationships with existing ER, FD, Duct., and T&T data