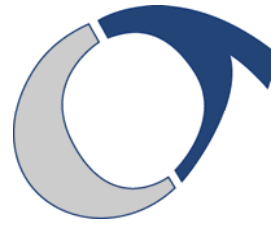


CHEM TECHNOLOGIES, LTD.

Beyond the obvious from innovation to application



CT(CR)-90 and CT(TR)-90

Cost Effective TDEC Replacements

Technical Report: CTR - 05001

March 2005

Confidential to Chem Technologies, Ltd.

Background



- **Tellurium diethyldithiocarbamate (TDEC) is a very fast accelerator. It is most often used as a secondary accelerator in combination with other dithiocarbamates, thiazoles and/or thiurams.**
- **TDEC is used extensively in EPDM, butyl and other slow curing polymers as an accelerator to increase cure speed.**
- **Tellurium dioxide which is used to make TDEC is sometimes in tight supply.**
- **Recently the cost of TDEC has increased substantially and there have been shortages as well.**
- **Over the past year Chem Technologies has been asked by customers to find a replacement for TDEC.**
- **We have developed CT(TR)-90 and CT(CR)-90 both of which can replace TDEC.**

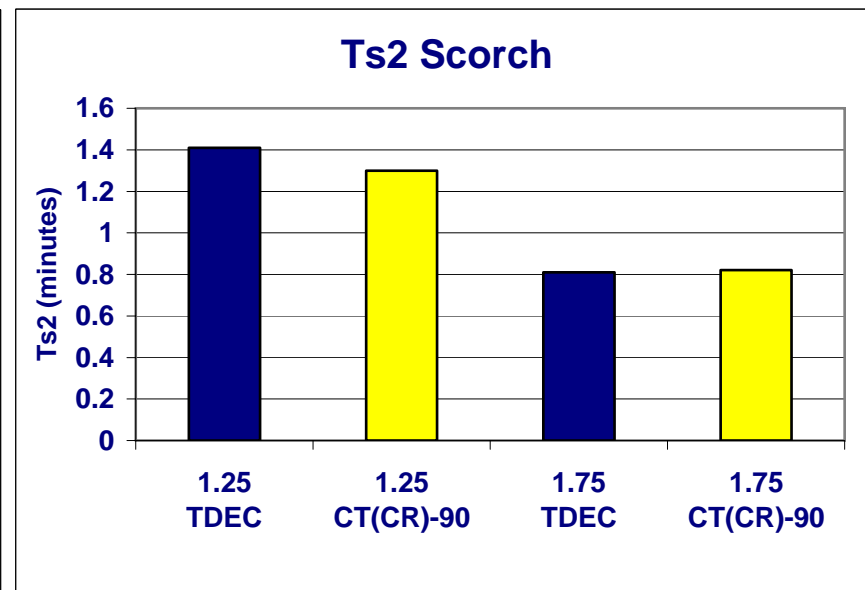
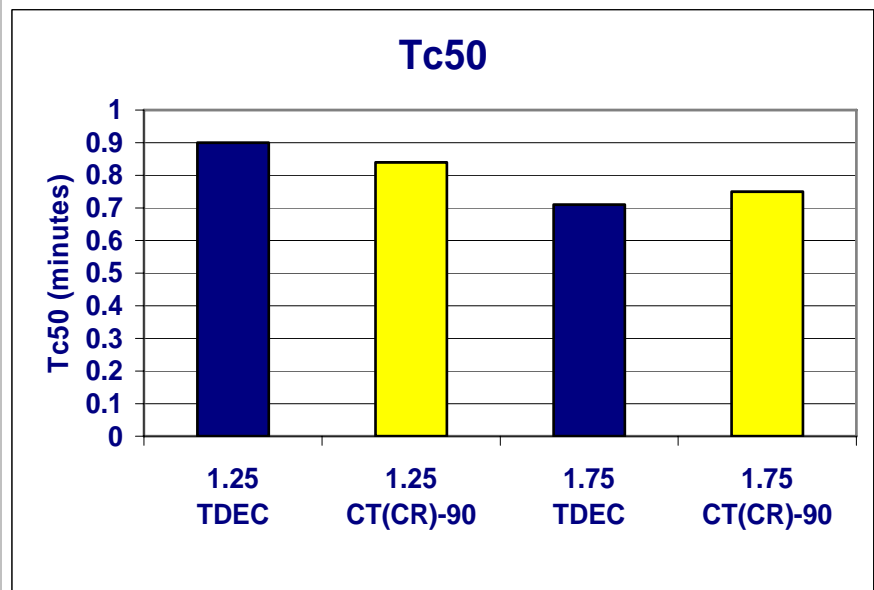
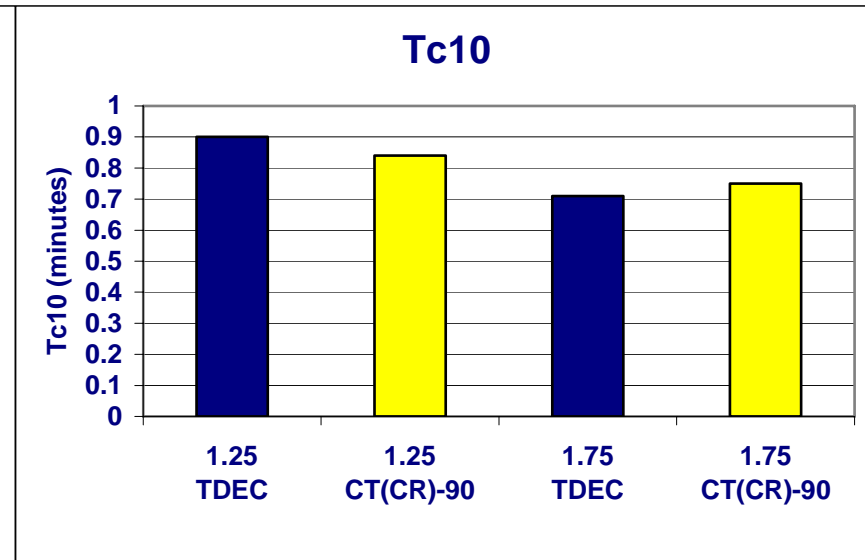
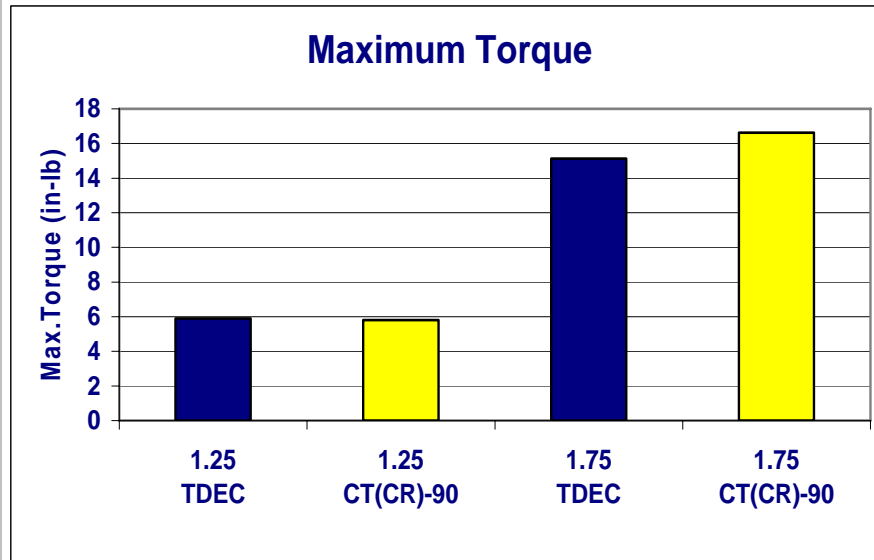
TDEC Replaced With CT(CR)-90

Butyl 269 Based Compound

**Dithiocarbamate / Thiazole / Thiuram /
Sulfur Cure System**

TDEC levels of 1.25 and 1.75 phr

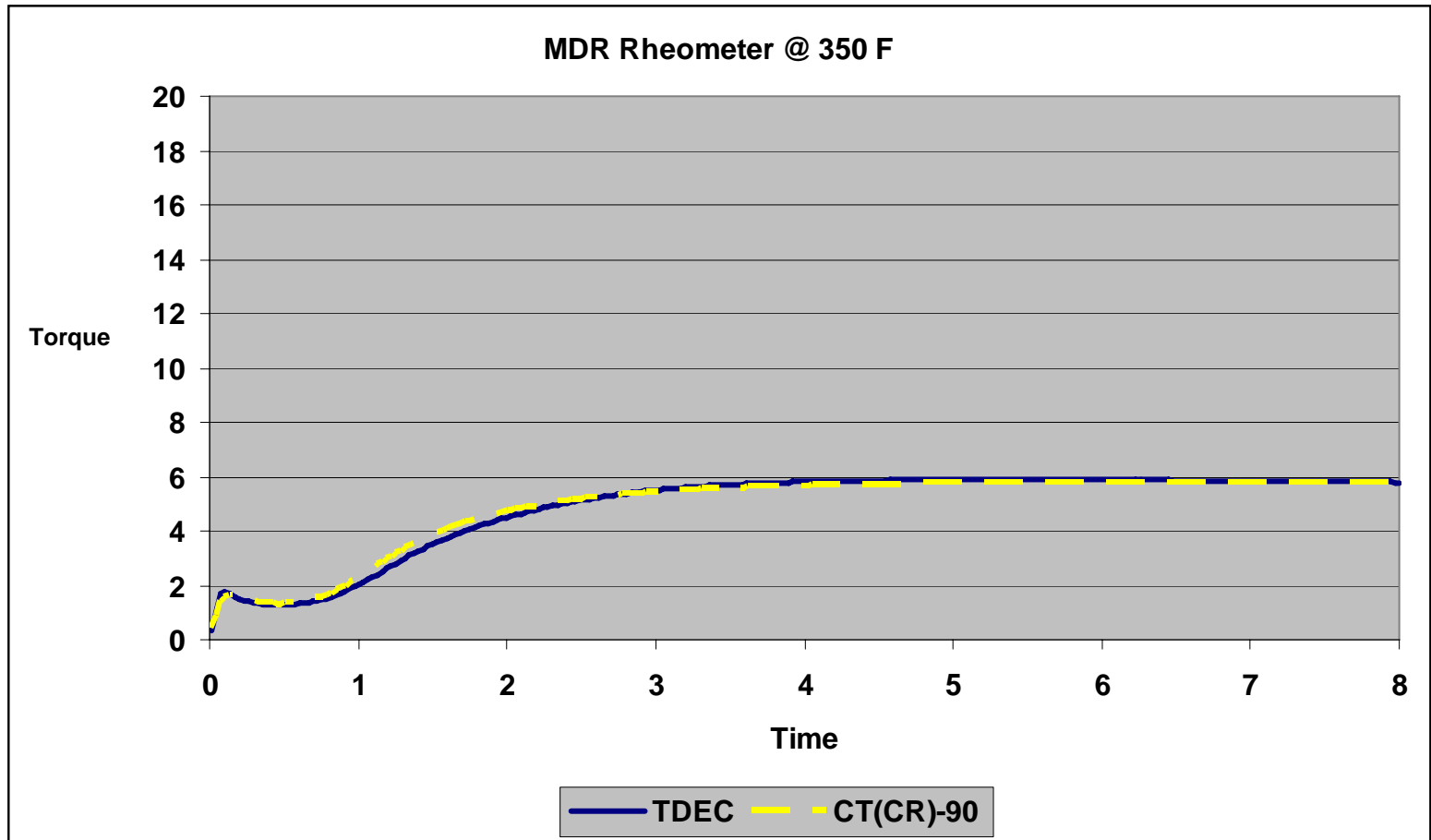
The CT(CR)-90 was put in at the same level as the TDEC and gave a similar cure properties.



Butyl 269 with TDEC @ 1.25 phr



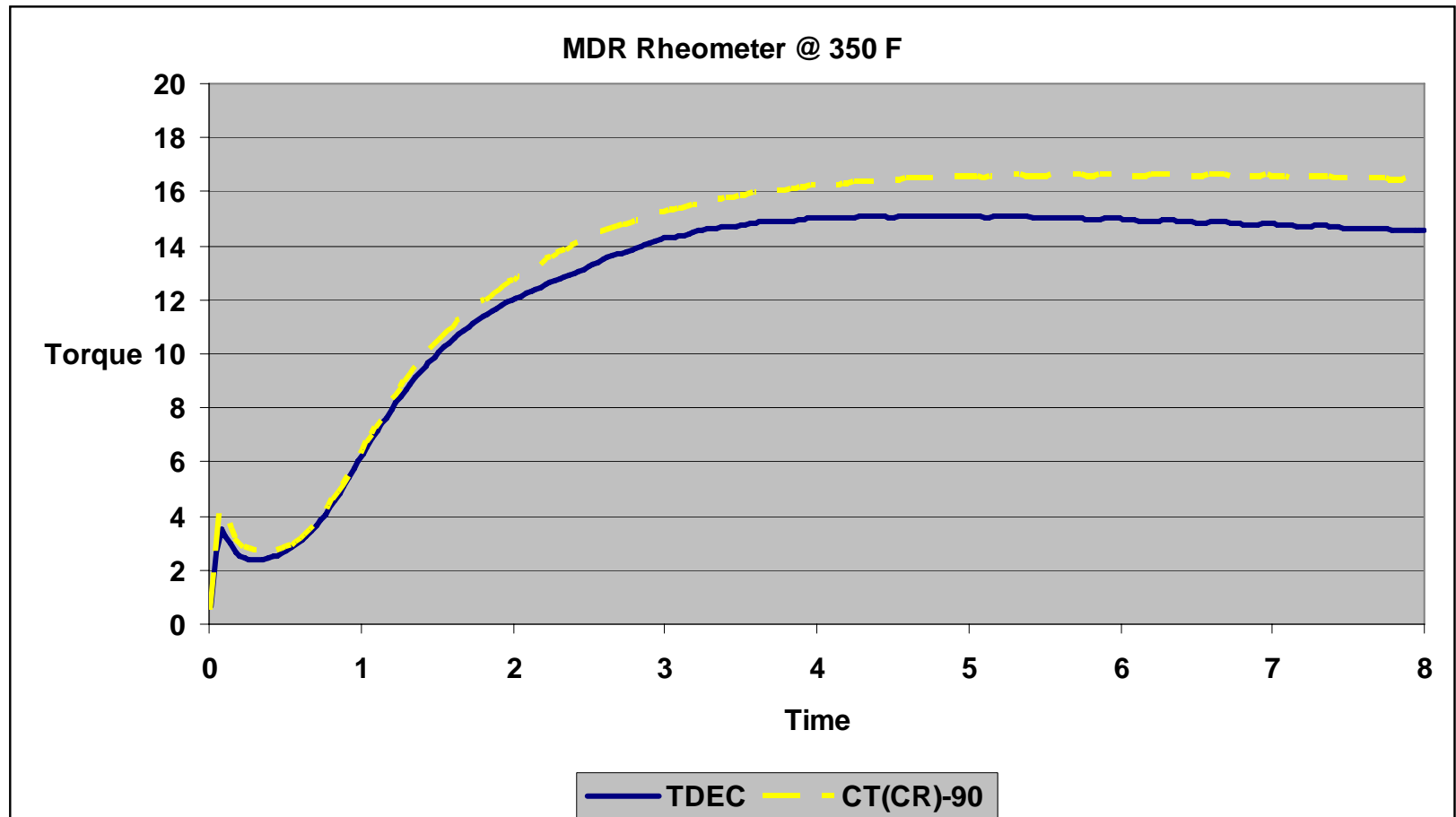
The CT(CR)-90 was put in at the same level as the TDEC and gave a similar rheometer curve.



Butyl 269 with TDEC @ 1.75 phr



The CT(CR)-90 was put in at the same level as the TDEC.
The CT(CR)-90 had similar scorch, cure rate but higher maximum torque and less reversion than the TDEC control.



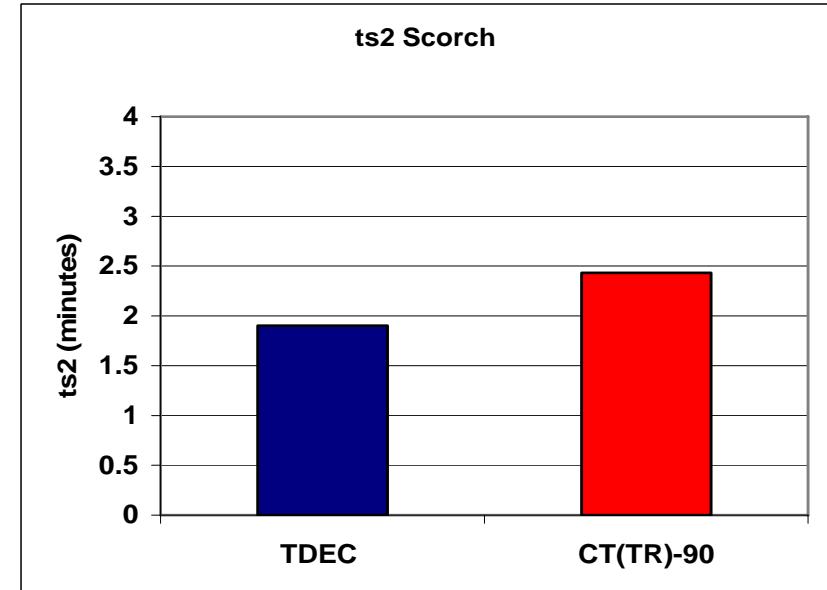
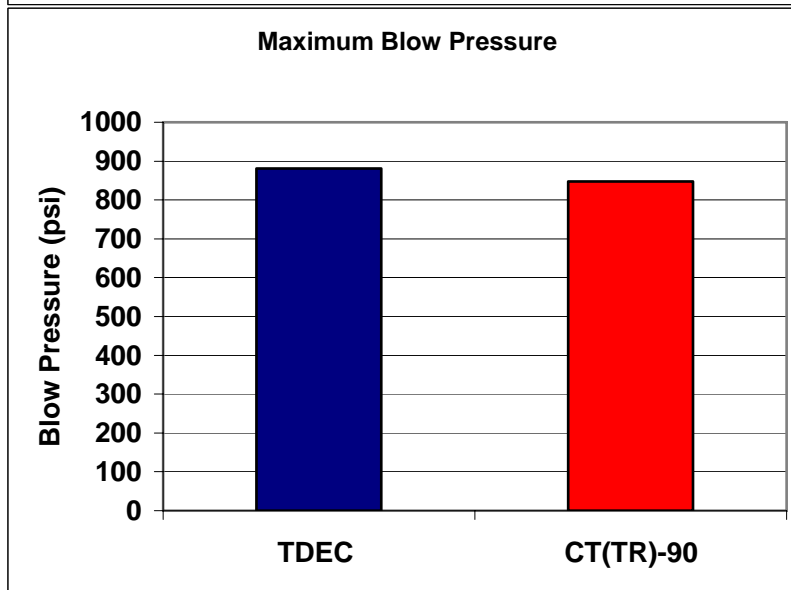
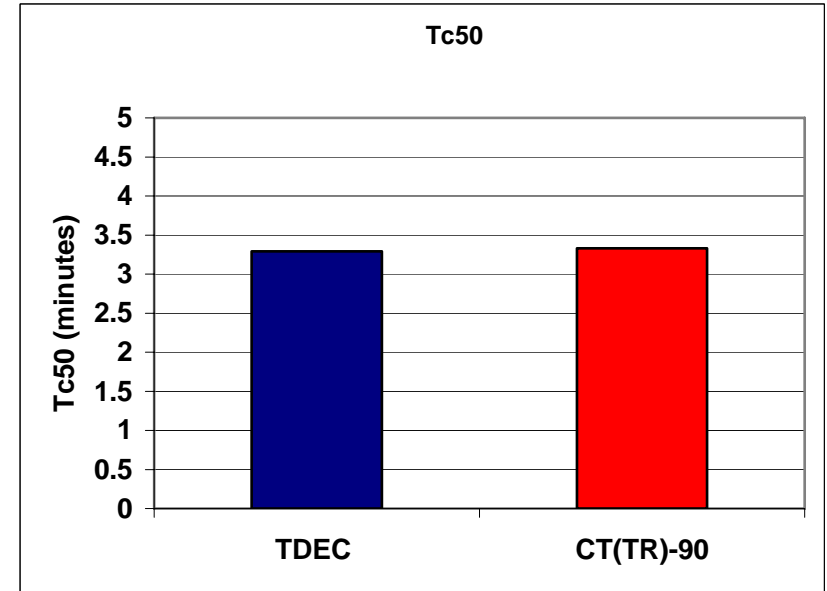
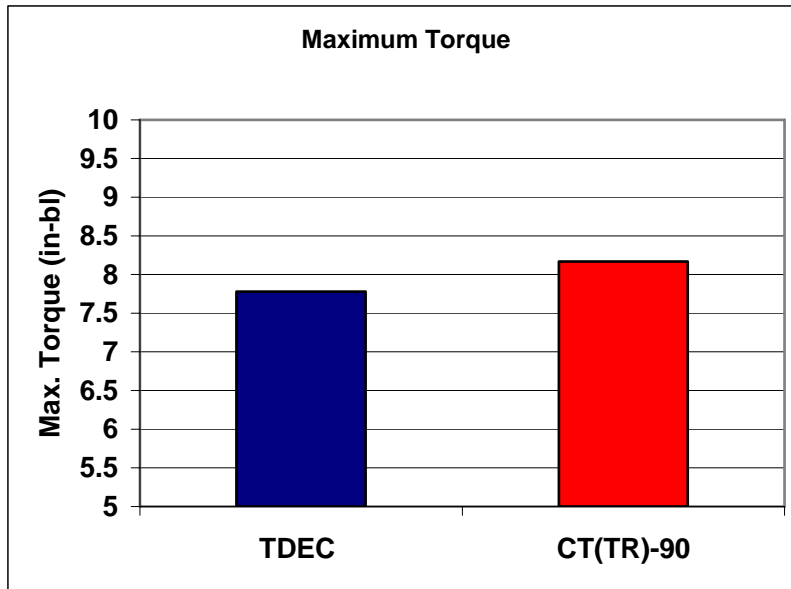
CT(TR)-90 TDEC Replacement

EPDM Sponge Compound

**Thiazole / Thiuram / Dithiocarbamate /
Sulfur Cure System**

1.5 phr CT(TR)-90 replacing 0.75 phr TDEC

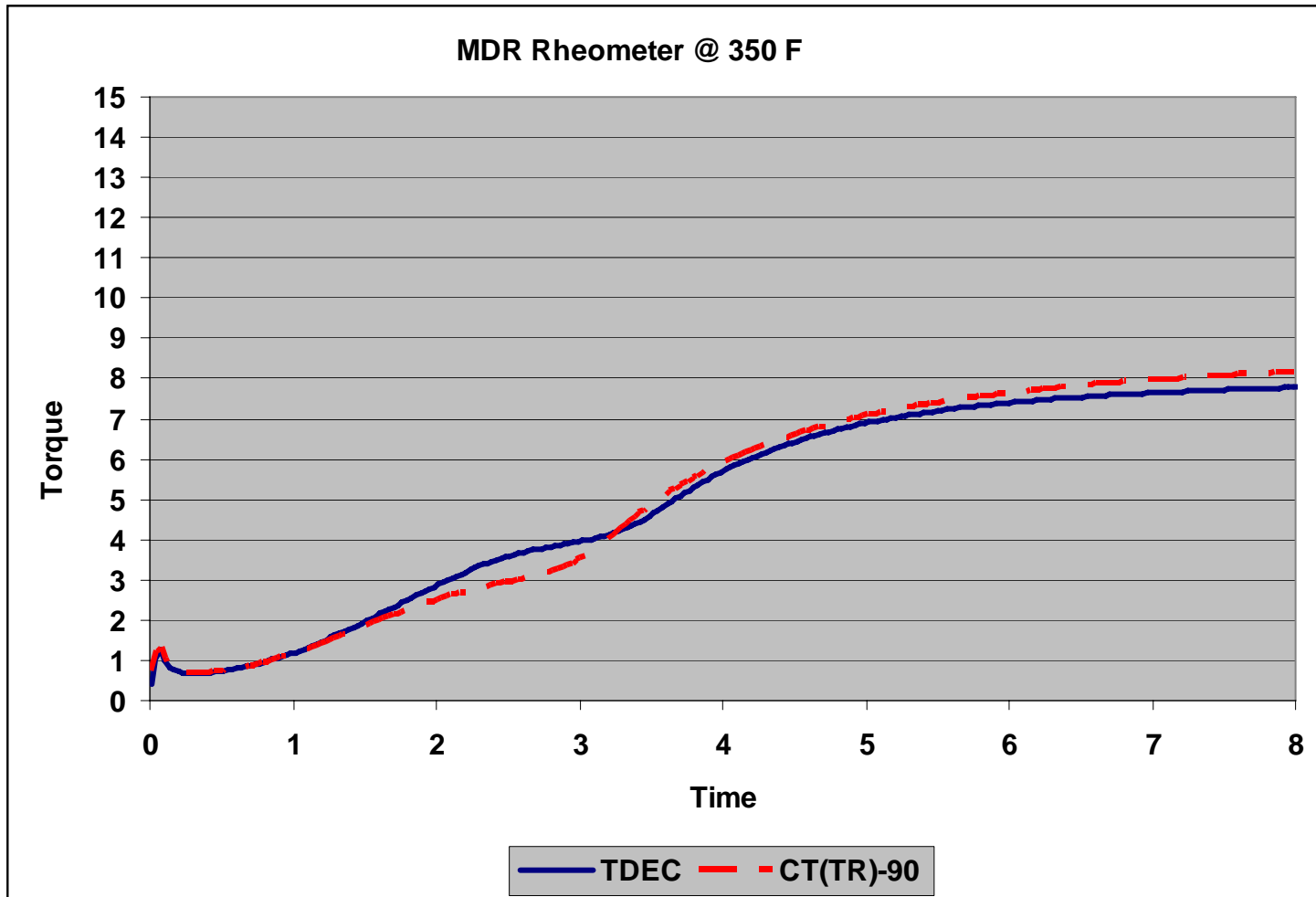
The CT(TR)-90 has a similar cure properties to TDEC in the EPDM sponge compound with slightly better scorch safety.



CT(TR)-90 in EPDM Sponge



The CT(TR)-90 has a similar rheometer curve to TDEC in the EPDM sponge compound.



CT(TR)-90 TDEC Replacement

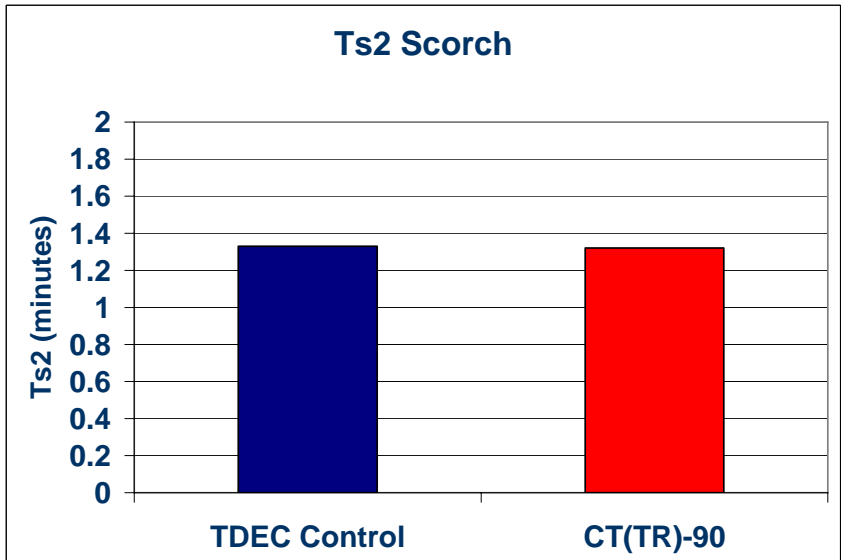
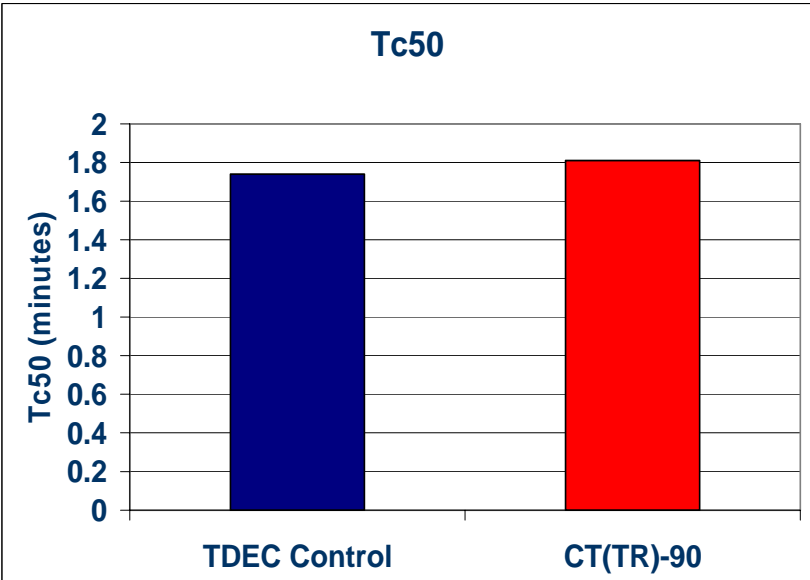
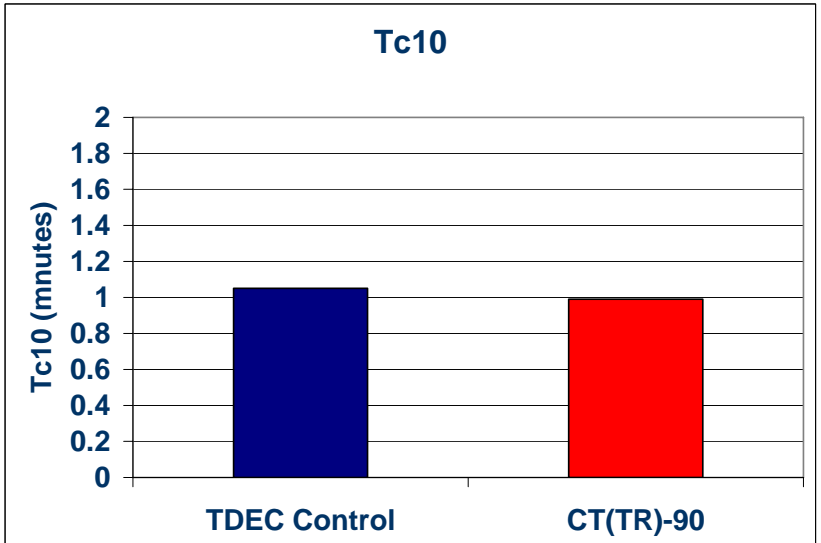
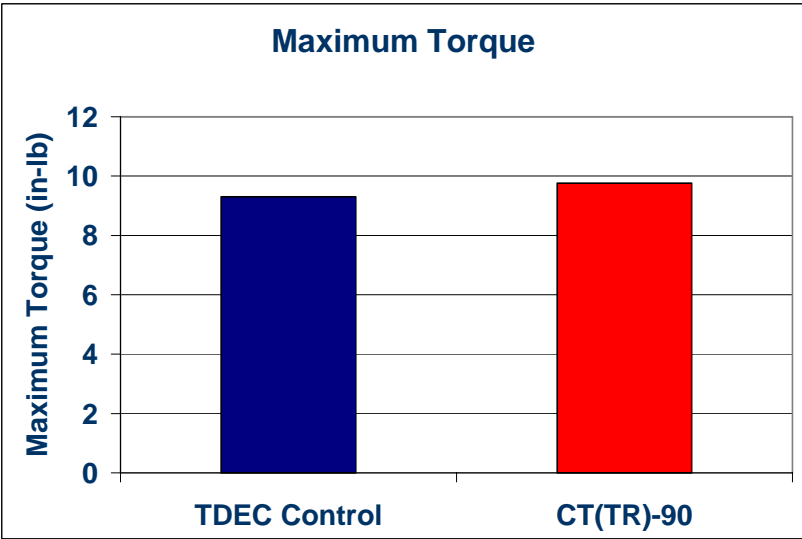
EPDM Dense Compound

Thiazole / Thiuram / Dithiocarbamate / Sulfur Cure System

1.2 phr CT(TR)-90 replacing 0.6 phr TDEC



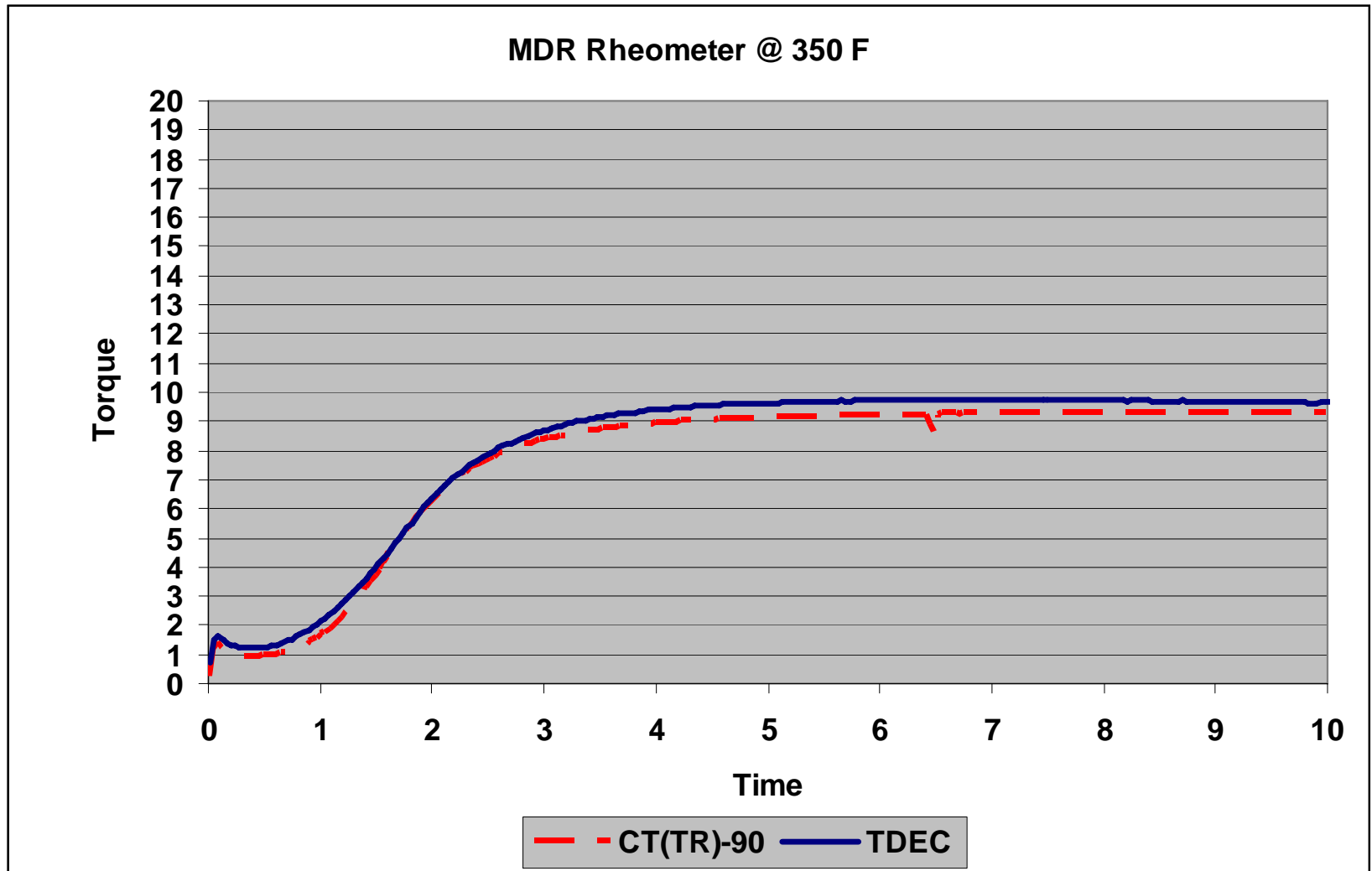
The CT(TR)-90 has a similar cure properties to TDEC and CETR in the EPDM dense compound.

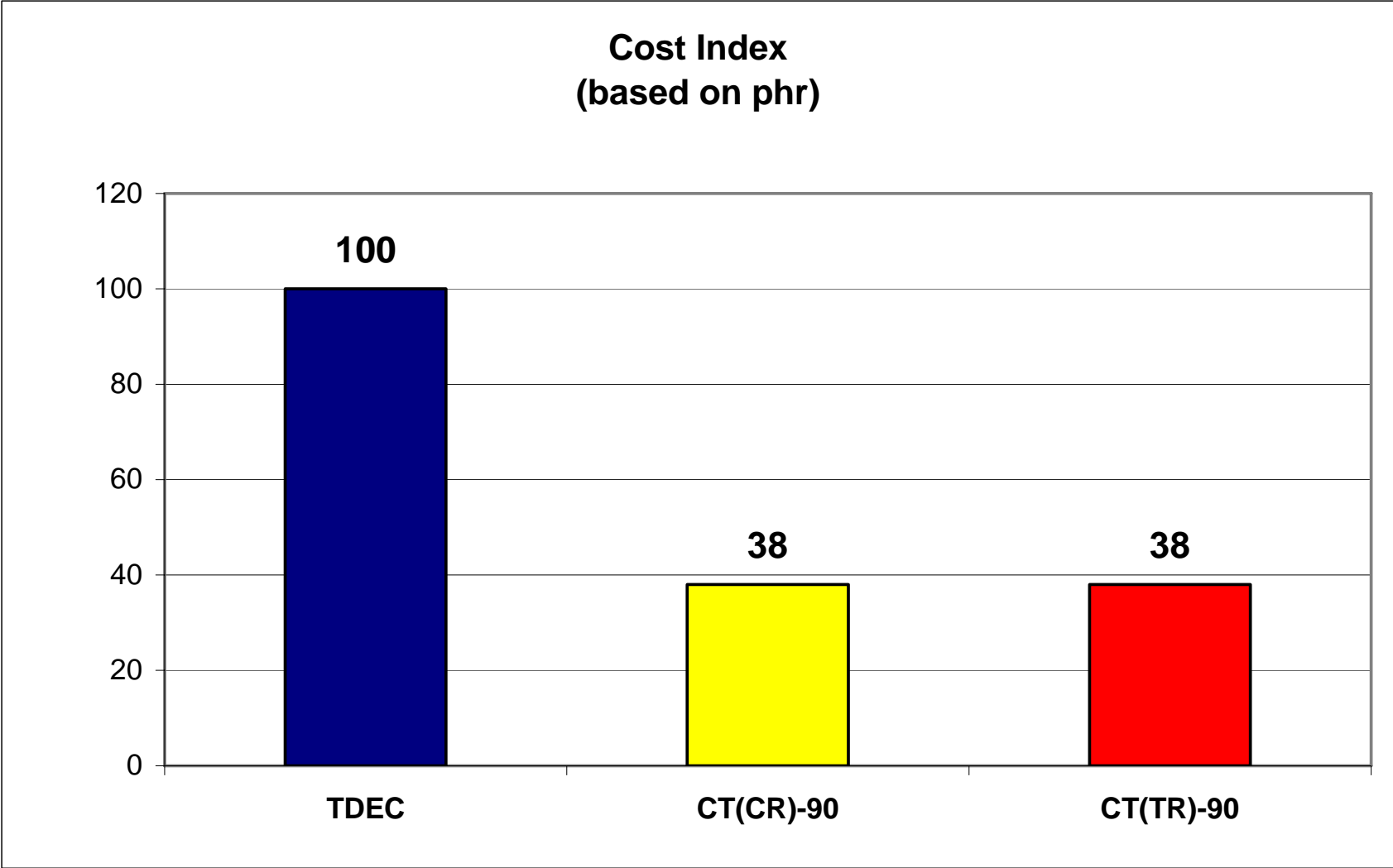




CT(TR)-90 in EPDM Dense Compound

The CT(TR)-90 has a similar rheometer curve to TDEC and CETR in the EPDM dense compound.





Conclusions



- **The CT(CR)-90 had similar cure properties to TDEC at two different phr levels in a butyl compound.**
- **The CT(TR)-90 had similar cure properties to TDEC in both sponge and dense EPDM compounds.**
- **In other customer based studies we have shown that CT(CR)-90 is slightly faster than CT(TR)-90.**
- **Both CT(CR)-90 and CT(TR)-90 offer significant cost savings versus TDEC.**
- **Recommended replacement levels:**
 - **CT(CR)-90: part for part replacement for TDEC**
 - **CT(TR)-90: 2 parts for 1 part TDEC**