# Thermax® Effects on Silicone Platinum Cure Systems

It is well known that carbon black can interfere with the cure mechanisms of silicone rubber. Typically, the sulfur content of the carbon black is an issue for a platinum cure system. Due to the relatively low sulfur content of Thermax® N990 and the even lower sulfur content of Thermax® Ultra Pure N990UP, it was theorized that the products could be used in conjunction with platinum cure systems at pigment loading levels (0-3 phr) without any negative effects. In order to investigate this hypothesis, Thermax® N990 and N990UP were evaluated in a platinum cured compound.

## The benefits of Thermax® N990 and N990UP found in the study were:

- N990 can be used with minimal effect on crosslink density up to at least 3 phr
- N990UP inhibits the cure less than N990 as evidenced by the scorch and cure times immediately after mixing
- Cure system stability was acceptable during 34 days of ambient temperature storage

The platinum cure formulations were based on a proprietary Dow® compound that was not disclosed to the authors. The pigment additions to this base compound are shown in Table 1. The relevant carbon black properties can be found in Table 2. On the following pages, the effect of the carbon black addition on cure properties and cure stability over time at ambient temperature are shown. The compounding and testing were performed by NovationSi in Barberton, OH.

### Table 1. Platinum Cure Formulations

| Ingredient | Control | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Dow Compound | 100 | 100 | 100 | 100 | 100 |
| N990 | - | 1 | 3 | - | - |
| N990UP | - | - | - | 1 | 3 |
| **Total** | **100** | **101** | **103** | **101** | **103** |

### Table 2. Carbon Black Properties

| Parameter | Units | N990 | N990UP |
|---|---|---|---|
| Nitrogen Surface Area (NSA), range | $m^2/g$ | 7.0-12.0 | 7.0-12.0 |
| Oil Absorption Number (OAN), maximum | $cm^3/100g$ | 44.0 | 44.0 |
| pH, range | [] | 9.0-11.0 | 4.0-8.0 |
| Total Sulfur, maximum | ppm | 150 | 60 |

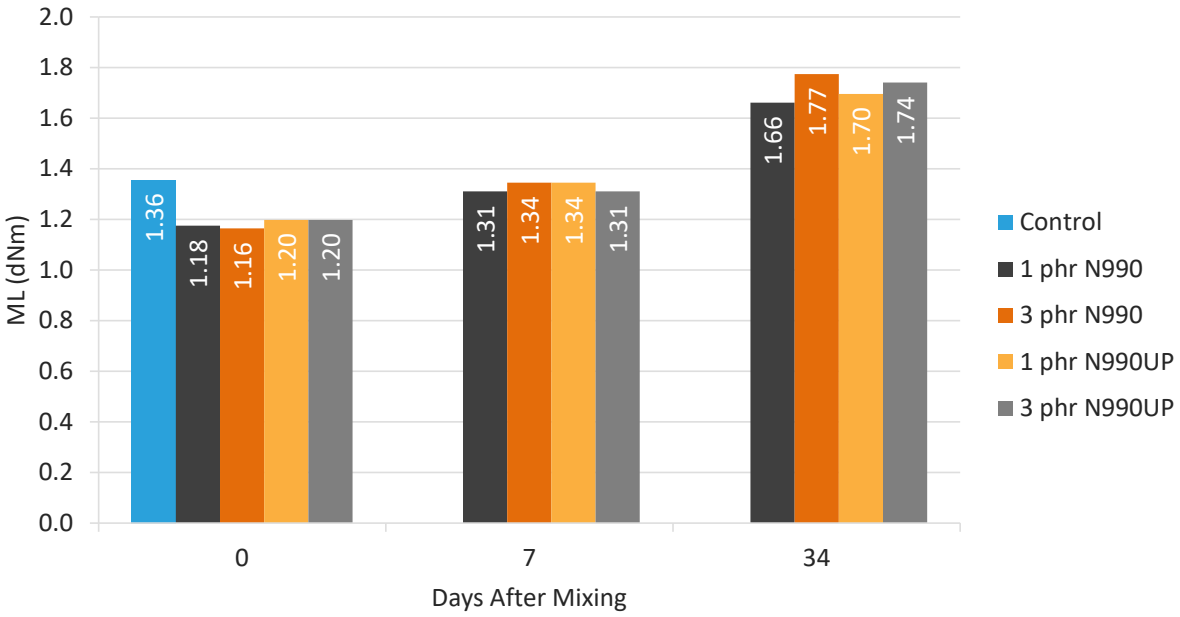


**Figure 1.** Minimum torque, ML, measured with MDR at 149°C and 1° arc for the platinum cured compounds. The immediate ML shows a reduction, possibly from the work done on the compounds during mixing. Over time, the ML tended to increase, indicating that the crosslinking reaction was proceeding, albeit slowly.

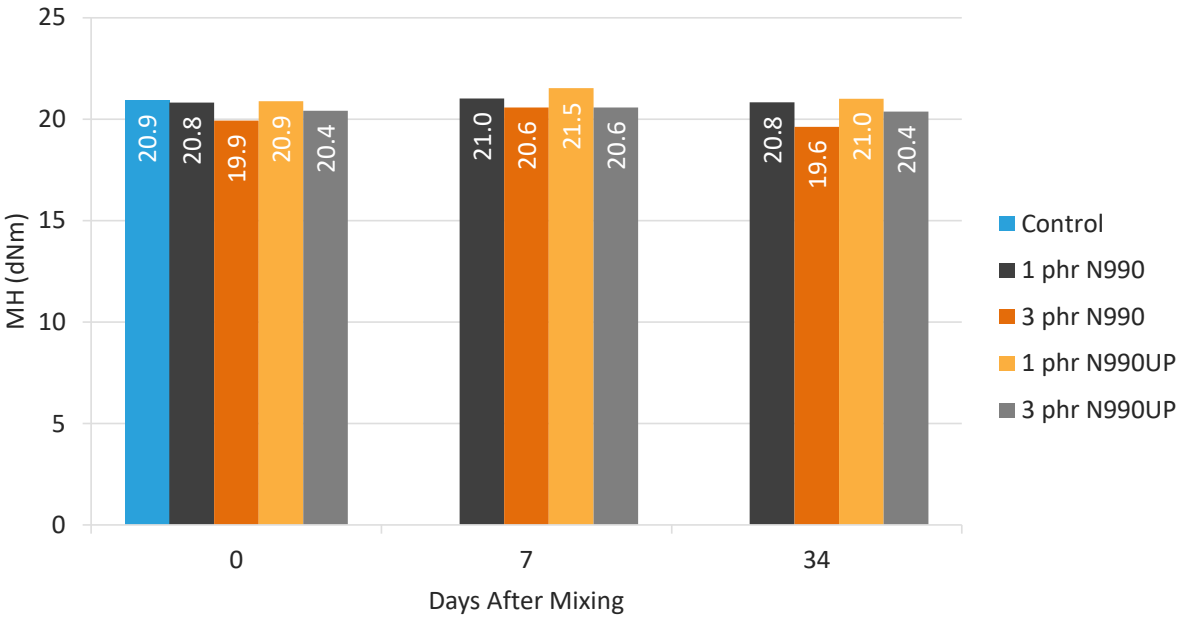


**Figure 2.** Maximum torque, MH, measured with MDR at 149°C and 1° arc for the platinum cured compounds. A slight reduction in MH at 3 phr loading was observed. There was no change in MH over time indicating good shelf stability.

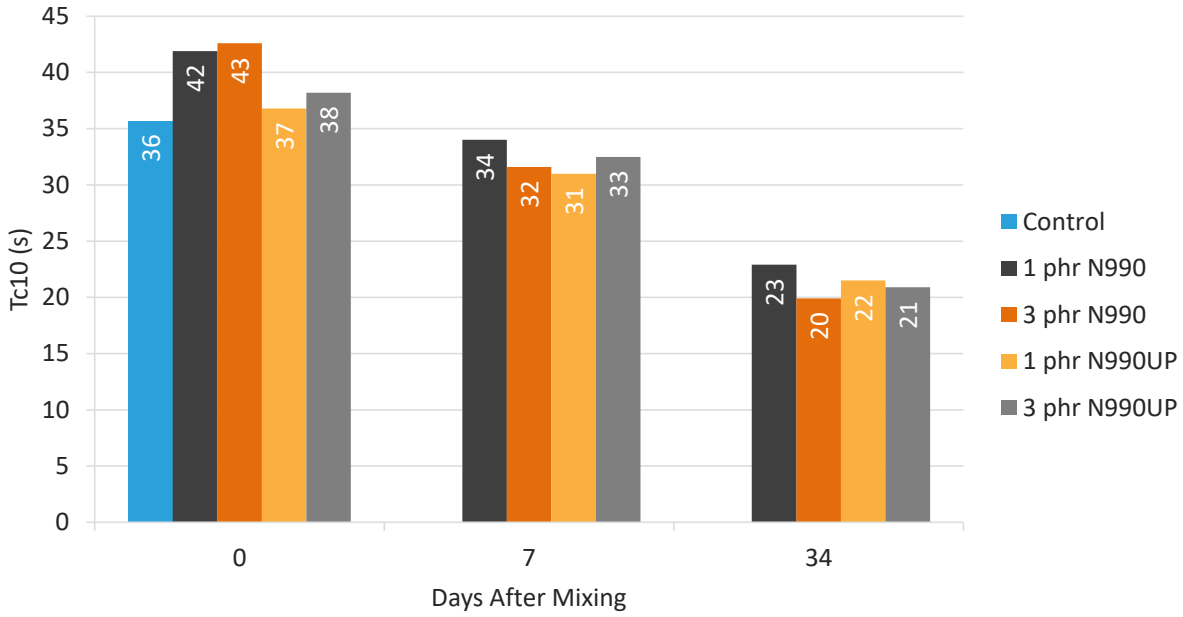


**Figure 3.** Scorch time, Tc10, measured with MDR at 149°C and 1° arc for the platinum cured compounds. The immediate scorch time increased, particularly for the standard N990, indicating that the UP product inhibits the cure less than regular N990. During storage, the scorch time decreased as the compounds slowly cured at ambient temperature.

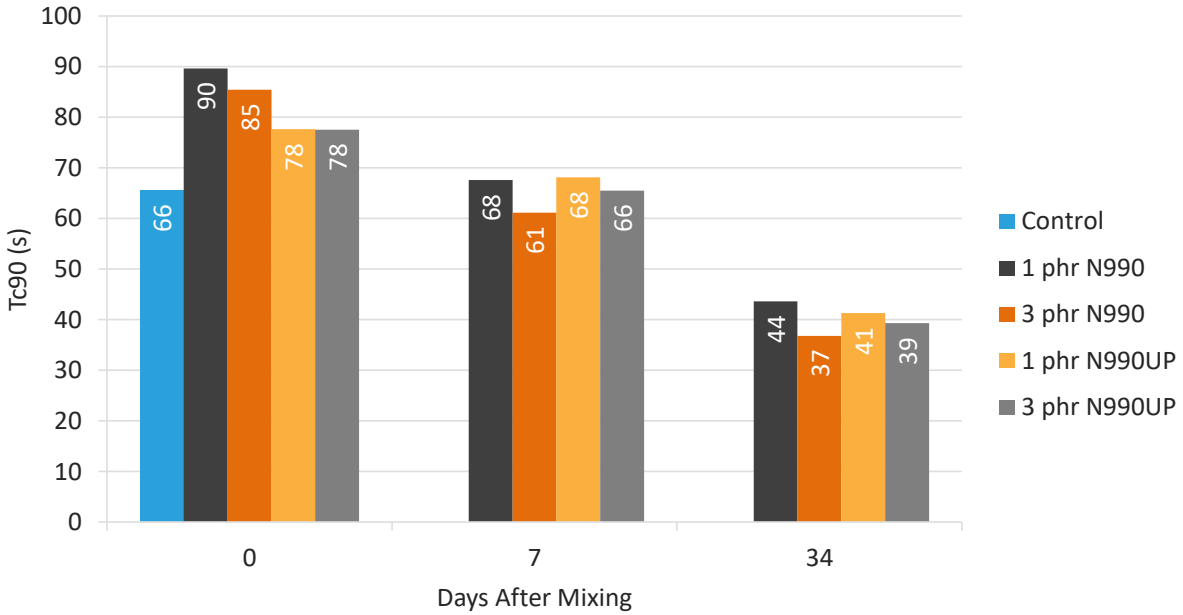


**Figure 4.** Cure time, Tc90, measured with MDR at 149°C and 1° arc for the platinum cured compounds. The immediate cure time increased, particularly for the standard N990, indicating that the UP product inhibits the cure less than regular N990. During storage, the cure time decreased as the compounds slowly cured at ambient temperature.