

Thermax® N990 in Butyl Condenser Packings

In this report, Thermax® N990 is evaluated in a butyl condenser packing compound. Condenser packings are a demanding application that require:

- Good dynamic properties to allow for expansion of the electrolyte
- Good sealing properties and low gas permeability to prevent leakage
- Low sulfur and chloride levels to prevent chemical reaction
- High insulating values

Exxon Butyl 268 is commonly used in this application due to its high levels of chemical resistance and gas impermeability. Thermax N990 is used in butyl condenser packings, typically as a blend with SRF or FEF carbon blacks.

The benefits of N990 found in the study were:

- **No change** in processability parameters, hardness, tensile modulus, compression set, and rebound resilience **while increasing total filler loading by over 45%** as compared to control compound
- **Large increase in volume resistivity** as N990 loading is increased, replacing N762
- **Reduction in compound cost** due to increased filler loading

The butyl condenser packing test formulations are provided in Table 1. The ratio of N990 to N762 was used as the independent variable in the design of experiments. The total filler loading was adjusted to maintain the target durometer of 70. Mooney, ODR, tensile, hardness, compression set, resilience, volume resistivity, and aged properties were collected for each compound.

Table 1. Test Formulations

Ingredient	Control	#2	#3
Exxon Butyl 268	100	100	100
Thermax® N990	20	66	95
N762	45	20	-
Translink #37	90	90	90
Stearic Acid	1	1	1
Zinc Oxide	3	3	3
SP 1045 Resin	20	20	20
Total	279	300	309

Detailed compound test results are provided in the figures on the following pages.

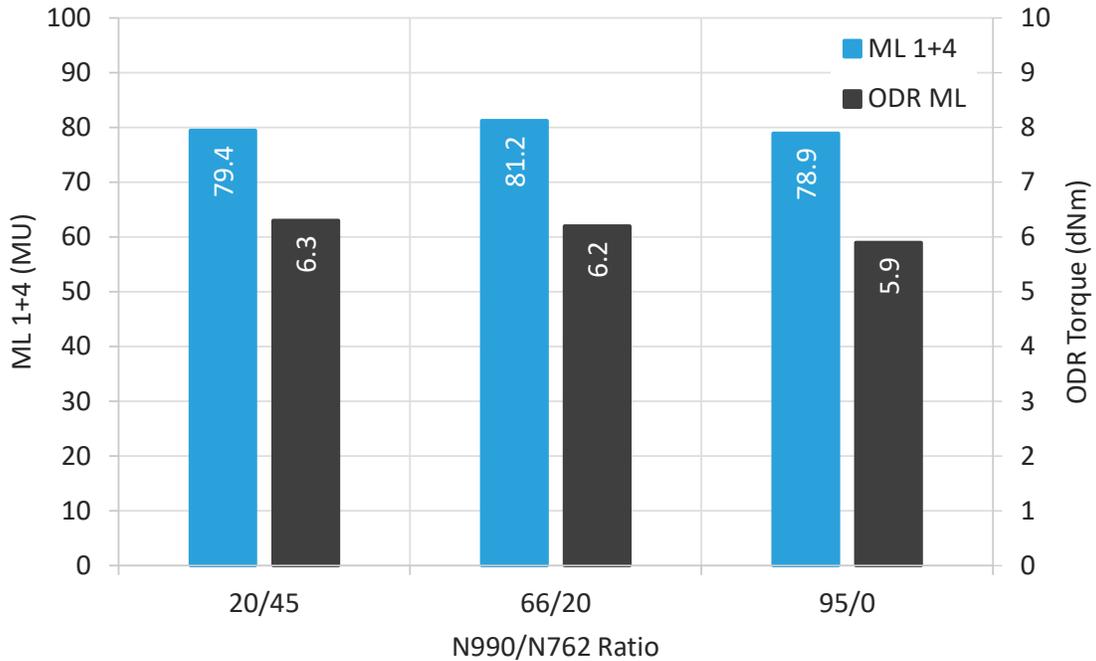


Figure 1. Mooney viscosity measured at 100°C and ODR ML measured at 190°C of the compounds. No significant differences were observed.

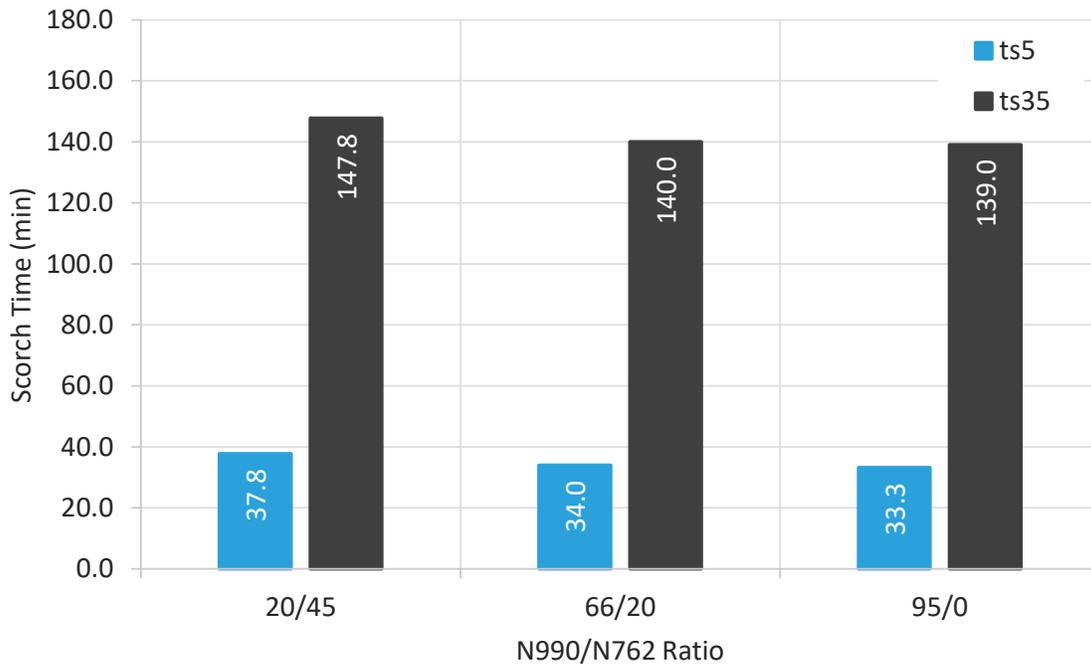


Figure 2. Scorch times measured at 125°C of the compounds. Scorch times tended to decrease slightly as N990 replaced N762.

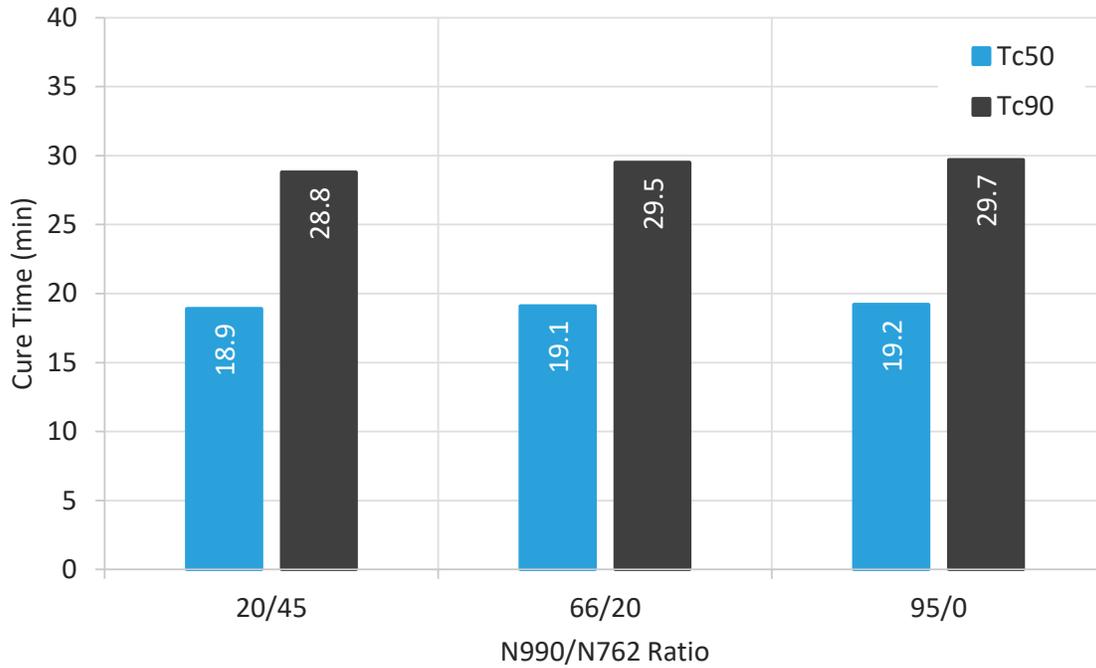


Figure 3. Cure times measured at 190°C of the compounds. No significant differences were observed.

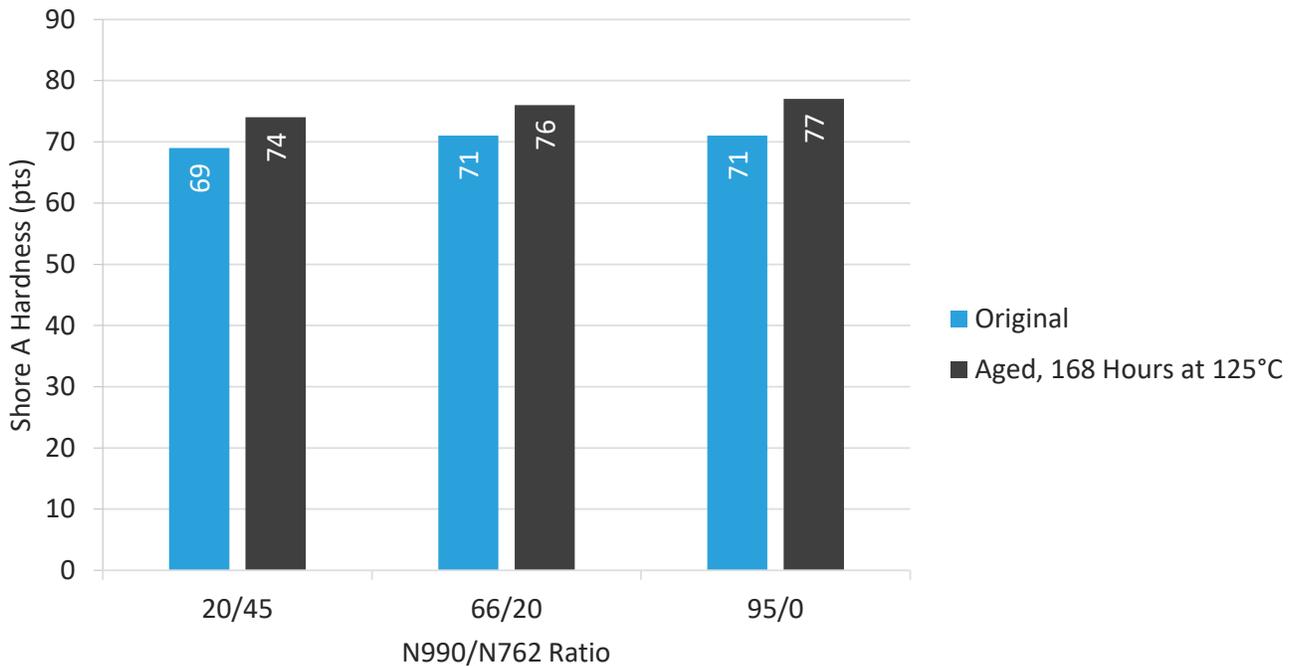


Figure 4. Shore A hardness, original and oven aged 168 hours at 125°C, of the compounds. All compounds were 70±5 Shore A with an equivalent change in hardness after aging.

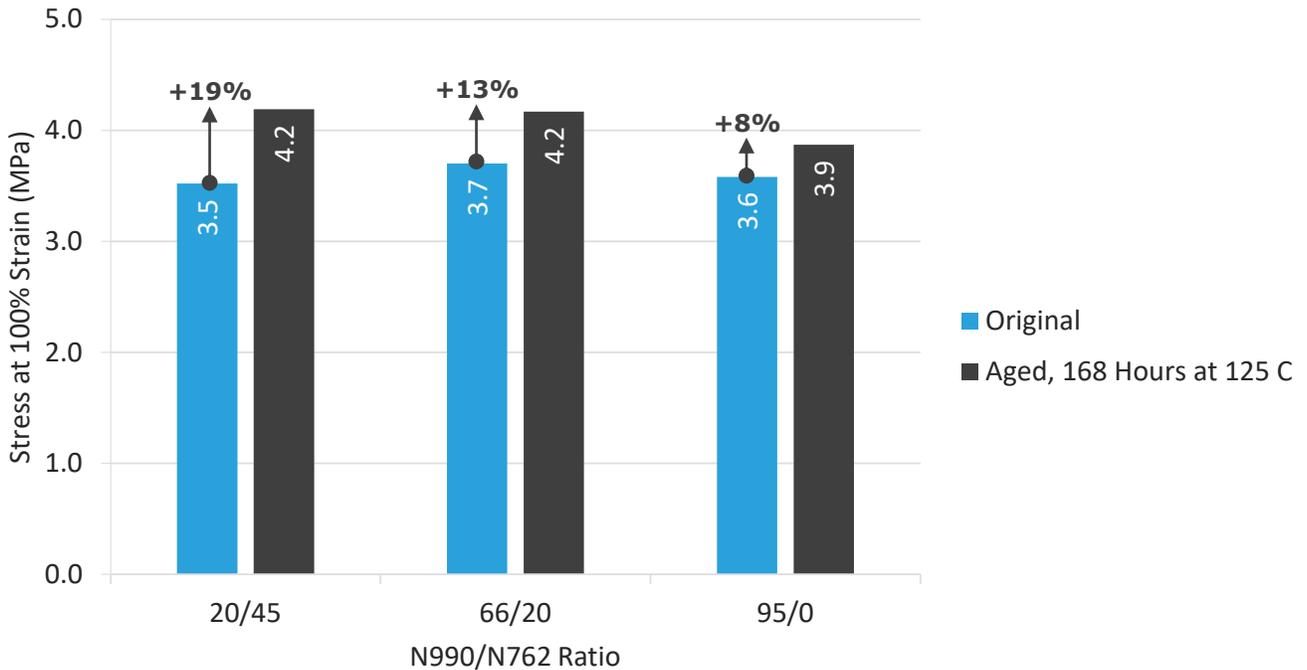


Figure 5. Stress at 100% strain, original and oven aged 168 hours at 125°C, of the compounds. No significant differences in original modulus were observed. A reduction in the change in modulus after aging was seen as N990 replaced N762.

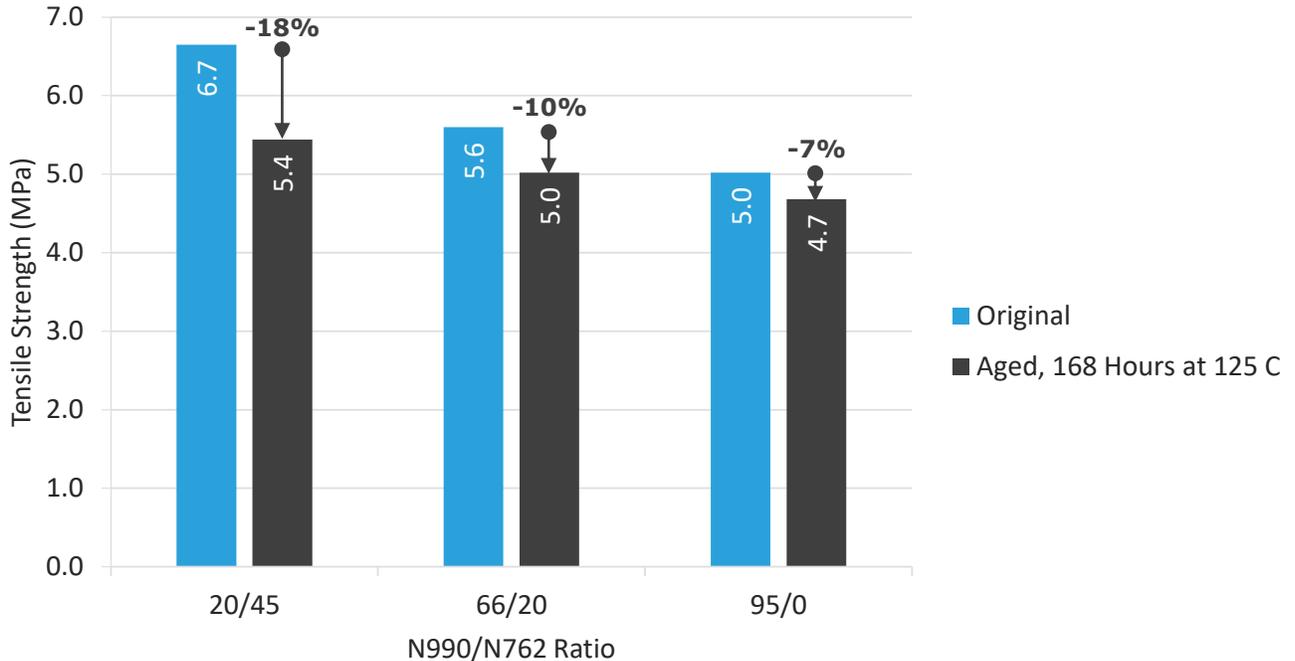


Figure 6. Tensile strength, original and oven aged 168 hours at 125°C, of the compounds. Tensile strength tended to decrease as N990 replaced N762. A reduction in the change in tensile strength after aging was observed as N990 replaced N762.

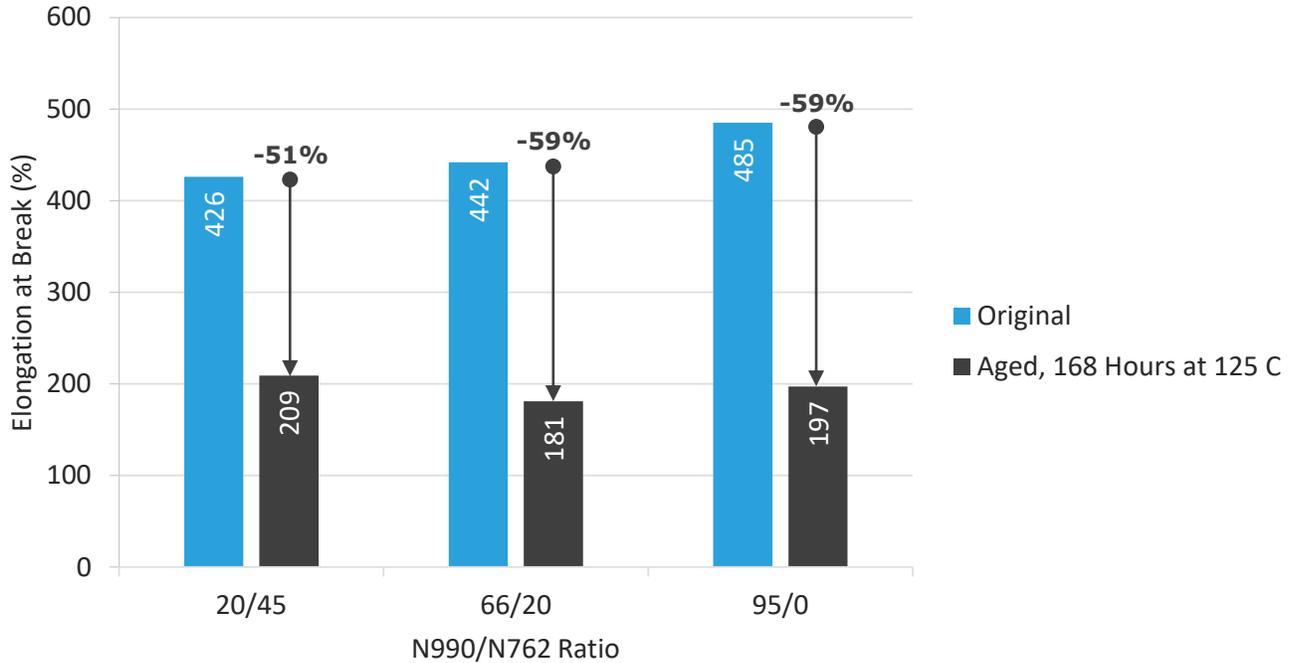


Figure 7. Elongation at break, original and oven aged 168 hours at 125°C, of the compounds. Elongation tended to increase as N990 replaced N762. An increase in the change in elongation after aging was observed as N990 replaced N762.

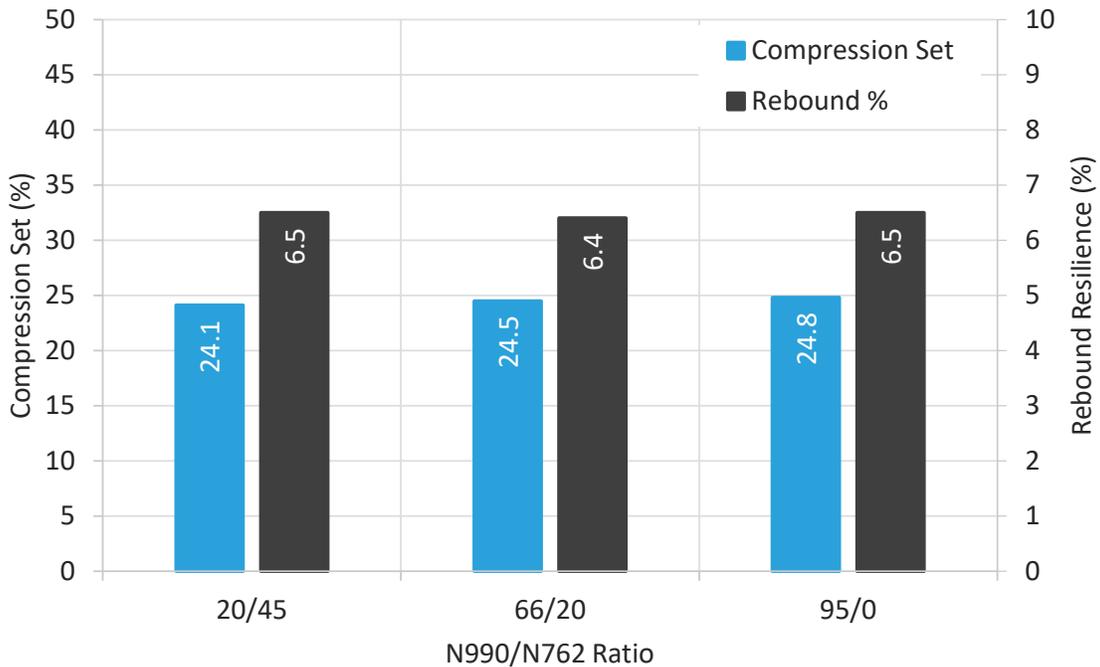


Figure 8. Compression set after 70 hours at 125°C and rebound resilience of the compounds. No significant differences were observed.

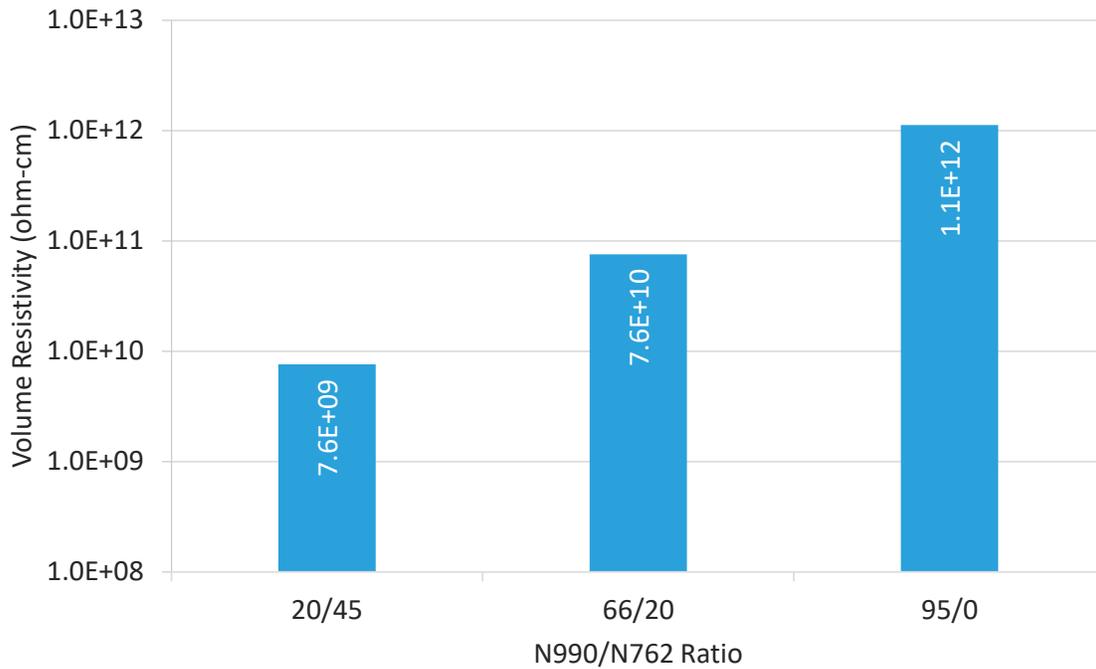


Figure 9. Volume resistivity of the compounds. Resistivity increased significantly as N990 replaced N762.