Samarium Cobalt (SmCo) vs Neodymium (Neo)

January 19, 2012

This article describes the technical differences between the two rare-earth magnetic materials—Samarium Cobalt (SmCo) and Neodymium (Neo)—used in Novak's brushless motor rotors.

Novak's **Ballistic 540 SmCo Tuning Rotor** (#5954) is an optional rotor for the Ballistic 540 Racing and Ballistic 540 Spec Brushless Motors.

The output power of both SmCo and Neo rotors are similar. The Ballistic motor design is based on a 28 MGOe (MegaGauseOerstead) energy product magnet and the SmCo is also rated at 28 MGOe. The difference comes into play as the rotor heats up. Since the SmCo rotor has a very high coercive force, they are not easily demagnetized. Thus, the SmCo rotor can tolerate about 250-350 °F more temperature rise than a Neo magnet before it begins to lose its magnetic power.

The Curie temperature of a Neo magnet is approximately 320 °C, and the Curie temperature of a SmCo magnet is approximately 800 °C. What this means, is if you heat a magnet without an external magnetic field, the magnet will lose all its magnetic properties at the Curie temperature.

Additionally, the coefficient of remanence of a SmCo magnet is about ¼ of Neo (-0.03%/C vs -0.12 %/C). Remanence is an indicator of materials ability to hold magnetization (magnetic storage). The lower remanence coefficient shows a ¼ lower loss of magnetic force due to increase in operating temperature.

Of course, you cannot run the motor this high of a temperature due to other components in the motor, but it will make the motor output power stay consistent for a longer time.

To summarize, a SmCo rotor will not demagnetize, or "fade", as much as a Neo rotor, and will withstand higher operating temperatures than a Neo rotor. Because of these advantages, SmCo material is the rare-earth material of choice for both military and industrial applications. Similarly, a rotor fabricated from SmCo material will offer performance and reliability advantages, and is recommended for all forms of R/C racing.