AMERICAN CARBON COMPANY

What is that White Powder Anyway?

If anything in the cathodic protection industry is commoditized it is magnesium anodes. In the past American Carbon has detailed the importance of buying anodes that perform as expected by reviewing ASTM G97 electrochemical testing. There is another facet to a magnesium anode that is critical to it's function – the quality and mix of the backfill in a prepackaged magnesium anode – you know the white powder every trucker asks what the white powder is on the pallet as you ship out finished anodes.

Our story starts in the 1940s when the Dow Chemical company was working to find ways to allow magnesium anodes to perform better in a larger range of environments. A patent filed in 1947 called for magnesium anodes to be placed in a mixture comprising gypsum, bentonite clay, and sodium sulfate, aiming to improve the conductivity and adhesion of the backfill to the anode. While the exact percentages weren't set it generally suggests the ratio of 75% gypsum, 20% bentonite, and 5% sodium sulfate.

Over the years several alternatives have been patented. In the late 1950s the Houston Oil Field Material Company was granted a patent that included expanded perlite to increase backfill adhesion to the anode. Then in the 1980s a few patents were filed again by the Dow Chemical company as well as Columbia Gas Systems Service Corp. These patents contemplate other material mixes to improve the function of the magnesium anode. Columbia Gas found that magnesium anodes often stopped protecting a steel structure long before the anode is fully consumed due to environmental reasons. Their studies found that adding a very small percentage of material that can release certain anions which in turn increase the reaction with the magnesium anode. This backfill design contemplated 76% lime, 20% bentonite, 2% gypsum and 1% fluoride. We aren't exactly sure why this backfill isn't in use today, but the 1940s formula is still the standard. Perhaps the cost of lime or smaller tolerances for the fluoride and gypsum are too small to accurately mix consistently?

While the materials required to manufacture a good mix seem simple enough, there are a couple pitfalls to be aware of. The largest is in the type of gypsum used in the backfill mix. There are two primary types of gypsum, hydrated or dihydrate (a naturally occurring gypsum mined and pulverized to size directly from the ground) and anhydrous or calcined (gypsum that has been processed to remove all moisture). A pile of these two materials placed next to each other would be indistinguishable – both are white powders. The appropriate type for this application is hydrated. The calcined gypsum resists absorbing moisture which is the specific purpose of the gypsum in the mix. Manufacturers cognizant of freight charges may try to use calcined gypsum in their mix due its static weight between the two types of backfill – since the calcined gypsum does not easily absorb water. The longer the freight journey the more enticing it is to use a static weight material.

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Visually speaking it is nearly impossible to determine which type of gypsum is packaged with the anode, but this simple test will allow you to confirm you have the correct backfill. Place about a cup of backfill in a bucket and add about ½ cup of water. Mix the two together. If your mixture forms a paste you have the correct gypsum. If the mixture does not turn into a paste, further exploration is necessary.

At the end of the day the purpose of the magnesium backfill is to lower the anode-to-earth resistance and to help retain moisture around the anode. This will result in a more efficient groundbed. To learn more about American Carbon and how our magnesium anodes are another key component to that groundbed, visit us on the web at amcarbon.com

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