COMMSCOPE®

Technical Report

Coaxial Bonding– Optimizing Preparation and Connectorization

Hardline coaxial cables have been used in the broadband industry for decades. During these years many refinements were made to these cables to produce the optimal cable electrical and mechanical performance. Today, with a better knowledge of processes and recent advancements in material, cables are again being further optimized.

Introduction

Coaxial cables have several interface areas between metals and plastics. Each of these interfaces offers a unique set of issues to the user and manufacturer, all related to the bonding of the plastics to the metals. It is bonding that enhances the mechanical performance of a coaxial cable; enabling improved bend performance, core retention, and inhibiting moisture migration.

Just as essential as the cable's mechanical performance is the ability to properly prepare and connectorize a cable. There must be a balance to achieve both with optimal results. This paper will provide an understanding of what trade-offs are made when going to the extremes in bonding, preparation performance, and the optimal zone for a cable to be in.

Industry Standards

To assure a cable's performance for the user, the industry has adopted standardized test methods and minimum specifications for defining the bond characteristics of coaxial cable.

As a starting point, the SCTE in its "Specification for Trunk, Feeder and Distribution Coaxial Cable" [ANSI/SCTE 15 2001] specifies minimum bond strength between the dielectric and the center conductor defined as "Dielectric Shear Adhesion". The bond strength values vary with cable size, with larger cables having higher bond strength requirements then smaller cables.

Advanced Coring Technology®

- Enhanced Mechanical Performance
- Meets/Exceeds ANSI/SCTE, EN50117, IEC and Cenelec Specifications
- Fully Backward Compatible
- Identical Electrical Performance
- Patent Pending

Cable Type	Bond Strength Miminum Pound Force
P3	
500	60
625	80
750	90
875	86
QR	
540	68
715	90
860	96

ANSI/SCTE 15 2001 - Table 10.0

As an example, a P3 500 cable size has a minimum bond strength requirement of 60 lbs, while a P3 750 cable size has a requirement of 90 lbs.

Additional important attributes of the bond are identified in this specification. First, a "Dielectric Shrinkback" requirement in which the shrinkback of the dielectric shall shrink no more than 0.250 inches (6.35 mm) from both ends of the sample following test procedure ASTM D 4565. Second, is the "Cable Static Minimum Bend" tested following ANSI/SCTE 39 2001.

The Bond

Typical bond strengths of today's cables well exceed these minimum requirements, being as much as 100% above that specified by ANSI/SCTE. Such a conservative approach is understandable given that there was no cost penalty to create a bond that performed at such a high level, and that operating at that level eliminated any potential for poor performance due to low bond strength. With excessively high bond strengths, controlling the consistency of the cable's quality is less demanding. The negative impact of this for the cable's user is a difficult preparation and connectorization process.

At the other end of the spectrum are poorly bonded cables that do not meet the specified ANSI/SCTE requirements. The typical cause of low bond strength is attributed to the inability to control a consistent manufacturing process. The negative impact of this for the cable's user is poor core retention, moisture migration, and poor bend performance (kinks easily).

There is an operating range, though, in between these two extremes of performance that facilitates a dielectric bond that will cleanly break away from the center conductor without sacrificing the mechanical aspects of the cable.

CommScope has developed, ACT (Advanced Coring Technology), a patent-pending bonding technology that operates in this window between the extremes. As shown in the chart in Figure 1, it exceeds the SCTE requirements for bond strength and provides for a clean and easy removal of the bonding material.

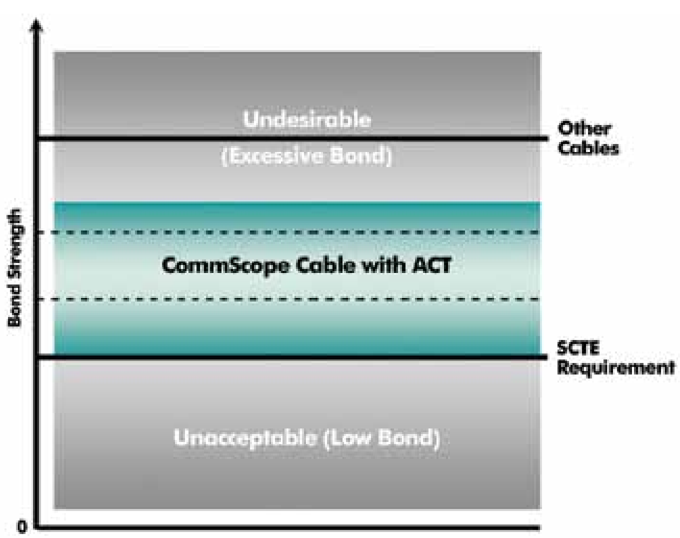

FIGURE 1

With this technology, the force exerted by the coring tool is sufficient to cause the dielectric to break away from the center conductor, leaving a clean conductor that typically does not require a second dielectric removal step. The tool and the craftsman can influence this enhanced performance characteristic of the cable, making a one step coring highly repeatable.

In addition to bond strength, the bonding agent also maintains the other key performance criteria of the cable as called out in the SCTE specification. Some of those criteria are listed in Table 1.

Measure	Passes SCTE Requirement
Center Conductor Bond Strength	4
Center Conductor Corrosion	4
Water Penetration	4
Air Transmission	4
Dielectric Shrink Back	4
Velocity of Propagation	4
Attenuation	4

TABLE 1 – CABLE PERFORMANCE WITH ACT.

Overall this solution provides all of the benefits of water migration deterrence, corrosion prevention, and mechanical performance while eliminating the performance risks associated with center conductor dielectric removal.

Summary

The bond strength in cable is critical to the mechanical performance of the cable. However, bonding affects more than just the cable's mechanical characteristics, it also impacts the facilitation of cable preparation and connectorization. Finding the balance of bond strength and craft friendliness is accomplished by the development of an advanced technology bonding agent and coupling it with CommScope's consistent manufacturing process controls. This achievement enables the cable to mechanically behave the way it needs to and makes the preparation easier.

For more information, please contact the
Broadband Resource Center
1-866-333-3BRC (3272) or BRC@commscope.com

COMMSCOPE®
1100 CommScope Place, SE • P.O. Box 1729 • Hickory, North Carolina 28603
Tel 1.800.982.1708 or 828.324.2200 • Fax 828.328.3400 • www.commscope.com