CONVERTING QUARTERLY
Web Processing & Finishing Technologies

R2R tech charges thin-film batteries

2012 Quarter 1

AIMCAL Official Publication of the Association of International Metallizers, Coaters and Laminators

Seamless roll coverings for coating, cast-film production

By Matthew Menges, president, Menges Roller Co., Inc.

Abstract
This article discusses the hidden issues resulting from the coating and/or cast-film production process, which can cause "build lines" or "extrusion lines" in a finished product. There are compounds and rubber-application techniques available that don't show these imperfections, ensuring a seamless roll covering for web-handling rollers.

"What are these lines in my coating or cast film, and where do they come from?" Roll building is not the same from all roll suppliers. A problem that exists during the application of the rubber to the roller core can cause hidden issues once the roll is in the coating or cast-film production process. Many roll suppliers refuse to admit the problem exists, and even fewer know rubber chemistry and the complex roll-building technology needed to eliminate the issue of "build lines" or "extrusion lines" after that roll is in production. Even though many times these lines can't be seen with the human eye, they do exist.

This firm has developed proprietary compounds and rubber-application techniques that will ensure a seamless roll covering. This type of covering allows the best lay down of coatings and cast-film extrusion that doesn't show these imperfections caused by the compliant rubber roller in their process.

Many processes that use rubber rollers develop problems with the finished coating or lamination due to the method used by the roller manufacturer when applying the rubber to the core. Most process engineers operating the equipment do not know what is causing the problem, which is typically magnified in sensitive coating projects. Process engineers who do recognize the problem refer to it as "build lines" that are caused by the way the roll is built; in other words, the way the rubber is applied to the roller core. The covering most often used for high-quality coatings or film extrusion is silicone.

Two covering methods

Rubber is applied to a roll core in either of two methods: "Calender" built or "strip" built. Calender building is winding the rubber on to the core much like a window shade (see Figure 1). The rubber is attached to the core and then the core is rotated, usually in a carriage of rollers that apply pressure to the rubber as it is being wound to remove air between the layers. This method is good, except that rubber calenders are limited in width to approximately 65 in. If the roller is wider than 65 in., another piece of rubber needs to be butted up to the end at 65 in., and it leaves a seam around the roller. In addition, the rubber — as it is applied to the roll core — leaves a longitudinal line across the face once the roller is finished. This line appears as a stripe across the face. As the calender rubber is applied and the supply roll of virgin rubber comes to an end, another piece has to be applied, which creates the possibility of another stripe across the roller when it is finished.

FIGURE 1. *"Calender"-built rubber-roll covering*

FIGURE 2. *"Strip"-built rubber-roll covering*

FIGURE 3. *"Lapping" process, seamless rubber-roll covering*

Different durometers and rubber compounds react differently, and some are more susceptible than others. The stripe that appears is usually just a strip from end to end and is merely just a color differentiation that cannot be felt. It looks as though it wouldn't cause any problem, but in production it reproduces the line, showing up in the cast film or in the finished coating. If the roll can be reground then it may not show up initially when the roll is installed; however, when it is reground and put back into production the defect appears. Usually, the process engineer who doesn't know the cause of the defect changes out the roll and dismisses the problem as a manufacturing defect.

The second rubber-application process is the extrusion method, known as "strip" built and mostly commonly used for large rollers (see Figure 2). Rubber is mixed and then stripped off a rubber mill in 3-4 in. strips approximately 3/8-in. thick. The roll producer typically inventories these for ready production. The strip is fed into a rubber extruder where the screw remixes the rubber and feeds it through a series of extruder screens that filter and remove any undispersed ingredients or foreign material. The rubber then exits the extruder through a die that profiles the strip for the best lay up for building the roller.

New "lapping" process

The roller manufacturer has to recognize the properties of this raw non-vulcanized rubber to allow for best knitting and crosslinking during the extrusion and vulcanization process. This firm has developed a proprietary process to ensure that the rubber, once applied, will become a monolithic sleeve of rubber with all of the exact same properties throughout the entire covering (see Figure 3). This process, called "lapping," uses the best strip profile, rubber chemistry and vulcanization techniques and flow-rate calculations to allow the rubber to stay rested during the application process and to eliminate rubber memory. "Rubber memory" is the term given to rubber because the material "remembers" everything that has happened to it prior to being cured. Once rubber is mixed, it starts curing. If left alone over time, it will cure simply from age.

Knowing your specific end-use application prior to roll covering is the first step to eliminating imperfections that cause these hidden defects within the roll covering. Most process engineers experiencing "build line" problems will only switch roll vendors in an effort to find a solution. This may solve the problem, but only temporarily.

Conclusion

Issues in a finished coating and/or cast-film production process with faint lines or ghost shadows that appear to have no source are likely caused by how rubber was applied to the rubber web-handling rollers. Seamless roll covering through the "lapping" process can be the solution when polymer chemistry has to be changed and complex curing techniques need to be applied. ■

Matthew Menges, co-founder and president of Menges Roller Co., Inc. (Wauconda, IL), has served the company for 28 years. He received his Bachelor of Science degree from the University of South Alabama. Matt is a member of AIMCAL and the Tooling and Manufacturing Assn., as well as the Rubber Roller Group. He can be reached at 847-487-8877, fax: 847-487-8897, email: mmenges@mengesroller.com, www.mengesroller.com