CRITICAL THINKING

by Dr. David Roisum

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What is the Best Surface for My Roller?

There are two aspects to roller surfaces: chemistry, which we will cover here, and topology, which we will cover next month. The chemistry of the surface is important because it affects the coefficient of friction (COF), release and abrasion resistance. Often we want a high COF so that we can control tension without breaking loose on driven rollers or leave undriven rollers behind. Wrinkle resistance, however, is improved with slippery surfaces. Release is important only for materials which are tacky. Abrasion resistance is important for only a few materials such as paper and glass.

The chemistry of the roller surface affects one other important property—cost. We want our machinery to cost no more than necessary to do the job. Thus, most roller surfaces are nothing more than the chemistry of the roller body itself. These commonly include aluminum for idler rollers, and steels or cast steels for process rollers. You will also see the occasional carbon-fiber idler roller, though carbon tends to be slippery and has very poor abrasion resistance.

Aluminum is not very abrasion resistant; you might see it anodized, sometimes called a "hard coat," which creates an abrasion-resistant oxide layer much thicker than what forms naturally. This surface coating also serves as a tattletail of wear. If the surface wears more than say a half-mil, the base metal will show through, so you know you need a regrind. Ironically, the people who need abrasion resistance the least, common converters, are the ones most likely to have it. On the other hand, the deep-pocket paper industry seldom does this, even though they run abrasive materials at blistering speeds.

Most metals tend to have similar COFs and release. Even so, there are several metal coatings that serve a vital function in certain processes. For example, electroplated chrome makes a very smooth surface to cast against and is much more durable to abrasion than is the roller-base metal. Tungsten carbide is a thermal spray product, suitable for most metals and occasionally nonmetals. The challenge in any case is the integrity of the surface bond to avoid spalling. Tungsten carbide is an amazing material. First, it is very abrasion resistant. Second, it can be sprayed on or ground to create topologies ranging from near-mirror smoothness to rougher than coarse sandpaper. Topologies can be used to handle air, increase traction against rough webs and improve release.

A very important category of roller surfaces is "rubber" covering, although the material is almost never rubber. While urethane is by far the most common covering, there are many other cover chemistries important for niche applications. For instance, silicone has two very useful properties: excellent release and it can withstand temperatures approaching 500 deg F. It also has two serious deficiencies: it's costly and has very poor abrasion and cut resistance. Tradeoffs are very common when selecting coverings. The most common reasons for covering rollers in the first place, however, is to reduce the intensity of the nip and to improve the uniformity of the nip profile. Occasionally covering may be used to improve traction. Alternatively, Teflon covers or sleeves provide excellent release. I hope this gives you a taste of better living through roller-surface chemistry!

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