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Controlling Static on an Unwinding Roll

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Abstract

Excessive static charges on insulating films are the root cause for a number of problems in roll-to-roll manufacturing operations. Static charges attract contaminants and cause discharges that can ignite flammable vapors, shock operators, damage machine control systems, and change the surface chemistry of carefully formulated products. Films are commonly unwound and wound several times in a manufacturing operation. For example, films formed by an extrusion process are wound. The roll may be unwound in a slitting or converting process and wound a second time in a customer roll. Finally, the roll may be unwound a third time in a customer application such as printing or in a label application process.

Static charges on the film are stored in each wound roll. Each time a roll is unwound is a unique opportunity to neutralize static. Presented here is a new, effective method for controlling static on unwinding rolls. The static control method has three key elements. First, the first conveyance roller after the unwinding roll contact the inside surface of the film. Second, a high performance static bar must be located to neutralize the outside surface of the unwinding roll. Third, a static bar must be located downstream of the first conveyance roller to neutralize the inside surface of the film.

The method to control static on an unwinding roll is analyzed to show that static charges wound into the roll from previous operations are substantially reduced. Also, static charge is separated at the unwinding nip by tribocharging of the inside surface of the film that is peeled from the outside surface of the roll. Analysis demonstrates that this charge is effectively neutralizes by this charge control method.

Finally, the effect of the first conveyance roller on static control is discussed. A static discharge in the gap between the film and the surface of the first roller is expected as the film approaches the roller. This “pre-nip ionization” requires that the first conveyance roller contact the inside surface of the film. Otherwise, the film remains highly charged through the production operation resulting in high static in the winding roll.