Coverstock Basics

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Wednesday, 20 September 2006
Last Updated Saturday, 30 September 2006

Did you every want to learn more about the coverstock materials of bowling balls? If so, this will explain the difference as well as show some microscopic differences between urethane, reactive resin and particle covers. Here is a composite of information from Columbia 300 and Ebonite as well as other sources.

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The following is from a variety of sources including Ebonite, Columbia 300, etc. The bulk of the text is from THE ROLE OF COVERSTOCK, from Ebonite. But, I have added in additional text from Columbia 300 as well as my own to help you better see the big picture.

To understand why a ball loses reaction, you must first understand the chemistry of a bowling ball’s coverstock.

A particle ball is a reactive ball with an additive that changes the surface friction characteristics of the coverstock. Additives differ in make-up, size and shape, and they can have frictionreducing or friction-enhancing properties. Particle bowling balls have mica, glass or ceramic beads located on the cover of a reactive bowling ball cover. If you looked at this ball under a microscope it would appear to be more jagged than a reactive ball on the cover. This innovation allows the bowling ball to act like a snow tire in oil providing more overall hook yet with a tamer backend. Particle is the choice for conditions with heavier volumes of oil. Similar to reactive, particle bowling balls also absorb oil as it travels down the lane. These external beads act like a snow tire causing the bowling ball to tend to arc. A reactive coverstock is made up of several components from the chemical families known as polyols, isos and plasticizers. All manufacturers of high-performance bowling balls use components from these families. When the components are mixed together, they start a chemical reaction. The polyol and iso components form a solid smooth structure commonly known as standard urethane (see diagram 1). Reactive Resin bowling balls skid more in oil and have a large amount of hook potential when making contact with the friction on the backends of the lane. So, the ball tends to skid and snap. The cover is also tacky. In the 1990s, manufacturers added resin to urethane material leading to a more porous, tacky and higher friction bowling ball that also hydroplaned in the oil. Since these bowling balls skid in oil, they store more energy and lead to higher scores due to the reaction when the ball hooks abruptly and hits the pins. Reactive bowling balls also absorb oil as it travels down the lane creating more friction on the cover when it hits the dry. As you can see from the image to the right, the reactive cover is more porous and oil deposits itself in these pores exposing drier cover to the lane surface. In the first full season, in which reactive bowling balls were used, the number of 300 games increased by 20% in one seasons, the American Bowling Congress reported 14,889 in 1991-92 and 17,654 the following year.

Diagram 1. Standard Urethane Coverstock

Plasticizers are the chemicals that increase a reactive ball’s hook potential over standard urethane. When plasticizer is added, it forms channels or pores in the urethane structure which increases oil absorption and gives surface texture to the coverstock (see diagram 2). Some plasticizer remains in the coverstock after the reaction takes place. The remaining plasticizer serves several functions that will be discussed later.

Diagram 2. Reactive Coverstock

Reactive resin balls work the same way. They also have oil absorbing cavities, but they are created using different additives which create a different cell structure as shown in the microscopic pictures below. Below is an AFM (Atomic Force Microscope) picture of superflex (Columbia 300). The dark areas are holes in the shell which creates oil absorbance. Think of the dark areas as worm holes which create oil absorption.

Thousands of microscopic channels make a reactive coverstock porous, allowing oil to be absorbed into the ball. As these pores are formed, the urethane compound becomes softer and less durable. At the same time, the plasticizer forms hills and valleys in the coverstock, making it look much like the surface of the moon (see diagrams 3 and 4).

Diagram 3.
Pores on the Surface of a Reactive Bowling Ball

Diagram 4.
Polished Reactive Coverstock Showing Surface Texture

Surface texture increases friction between the lane and the coverstock, causing reactive balls to react very aggressively in the backend. The proper balance of chemicals in a reactive ball creates the surface texture needed for aggressive backend reaction as well as the oil absorbing channels that help keep the friction as high as possible.

And, now there are Epoxy covers. Take a peek at this image of the cover. These caverns are larger and wider to absorb oil more easily. The next AFM pictures are microscopic images of Catalyst at the same magnification. as the Columbia 300 picture above. Here the cavities are much larger creating a rougher surface. These cavities are created by the unique additives.

END NOTES:
In an effort to increase the bowling ball reaction, bowling ball manufacturers began to add plasticizer to bowling balls in an effort to impact the shell or cover material.

Reactive resin is a urethane coverstock that has plasticizer additives that increase the friction characteristics thereby increasing a ball's hook potential (McCorvey's Pro Shop).

Plasticizer is an organic ester compound made by heating acids and alcohol in the presence of a catalyst. It makes plastics flexible without sacrificing strength or durability (Dow Chemicals).

A material of lower molecular weight added to a polymer to separate the molecular chains. This results in a depression of the glass-transition temperature, reduced stiffness and brittleness, and improved processability. Most plasticizers are nonvolatile organic liquids or low-melting point solids, which function by reducing the normal intermolecular forces in a resin thus permitting the macromolecules to slide over one another more freely (About.com).