Understanding the relationship between core and cover stock
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Lesson 2

Courtesy of USBC Equipment Specification and Certification

The previous article entitled "**Core Properties**" described and explained a bowling ball's core dynamics as it relates to ball reaction and performance. In this article, the other half of ball reaction will be broken down and investigated.

In the end, a bowler should understand the relationship between the core and cover stock. A bowling ball's shell is in direct contact with the lane surface and oil. Therefore, it is important that the designed cover stock have the correct chemical composition to maximize the relationship with the core and the desired ball motion.

There are four main types of cover stocks: plastic, urethane, reactive urethane and particle.

Plastic

The shells (cover stocks) of a modern bowling ball can be composed of several types of ingredients. Plastic bowling balls begin with a polyester type resin mixing with peroxide that hardens to form a not-so-porous solid.

Plastic bowling balls came onto the market in the late 1950's. These balls have a very hard and abrasive resistant surface. Typical sanding and polishing techniques do not have the same impact on these types of cover stocks.

The amount of friction and hook for plastic balls is generated by their shell hardness. Plastic balls are generally used when the lanes are extremely dry or for spare shots when a straighter ball path is desired.

Urethane

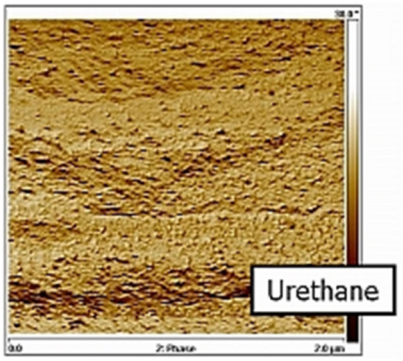
The initial chemical reaction for any type of urethane-based ball is between two different liquid polymers, a polyol and an isocyanade, which create a chain-like series of reactions

that ultimately harden into the urethane shell.

Urethane bowling balls, introduced in the early 1980's, were originally designed to hook more than plastic balls. The amount of hook on these balls could be manipulated without changing their surface hardness but rather the composition of the cover stock; however, they do not absorb oil well.

Urethane does have higher friction in oil and on the back end of the lane compared to plastic.

Compared to reactive urethane, urethane balls have less friction, especially down lane, and therefore have much tamer and mild back end reactions. Due to the less aggressive nature of urethane balls on the back ends of the lane, they can provide a gradual, more controllable hooking motion down lane.



However, this tamer reaction gives up the entry angle that a reactive urethane ball provides. With less entry angle, there is less pin action and quite possibly less carry.

Left is a 2µm x 2µm high-powered microscopic view (Atomic Force Microscope) of a urethane shell. The dark areas represent depressions or pores. Notice that not many dark areas are present.

Click on the image to enlarge it.

Reactive urethane

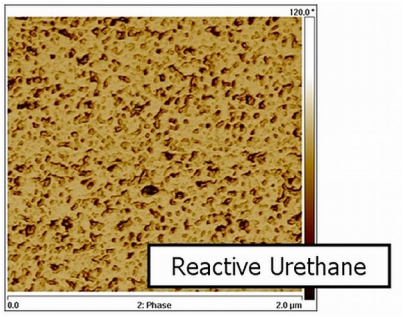
Reactive urethane is simply a urethane cover stock with an added "reactive" ingredient and was first marketed in the early 1990's.

The extra additive in the shell formula allows for microscopic pores to be formed as the polymer shell cures from a liquid to solid. These pores are very important because they allow the reactive urethane shell to absorb lane oil.

The ability to absorb lane oil is crucial to ball reaction. As the ball absorbs the lane oil as it travels down the lane and in between shots, the ball's surface remains in a "dry" state.

A drier ball surface contacting the lane will have increased friction and more hook compared to a ball surface that is slick with oil and can not absorb it (oil stays on the surface of the ball).

Just as the oil in a car helps to lubricate various parts, oil on the lane acts a lubricant as well. From a bowling ball stand point, if the chemical composition of the shell can help remove the lubricant, then the ball's total hook potential increases.



Reactive urethanes are known for their ability to slide in oil and hook on the drier back end of the lane. left is the same size Atomic Force Microscopic view of a reactive urethane shell.

Notice that compared to urethane, reactive urethane has many more dark areas that represent depressions in the scan. These depressions are the pores that absorb oil.

Click on the image to enlarge it.

Particle

Particle balls came out in the late 1990's and are mainly reactive urethane shells with some particulate mixed into the shell.

Particles can be of various microscopic size, shape and composition. Some particles are hollow and once thrown or sanded, the particles can break open, creating extra cavities to which lane oil migrates. These cavities help increase oil absorption as well as add texture to the ball's surface.

A practical example would be the treads on a snow tire. The treads give a place for the snow to go so the tire can grip the road better. Hollow particles act in this same manner resulting in earlier and more hook.

Other particles act to mainly change the surface texture, or roughness. These sharper edged particles extend through the oil thickness and act to grip the lane. This also amounts to increased hook in the front, oiled part of the lane.

In either case, the amount of friction between the particle ball and lane is changed as compared to a straight reactive urethane shell. Earlier and increased hook can be expected for particle balls.

With an understanding of bowling ball core properties and dynamics and cover stock choices, bowlers can match a particular core and cover to best suit his/her game based on the lane conditions and surfaces being bowled on.

For example, on a freshly oiled lane, a bowler might want to start with a particle cover stock and a low to middle RG/Diff RG combination. The cover stock/core match will allow the selected ball to start hooking in the oil and help the ball reach the ideal break point and finally get to the pocket.

As the session progresses, the lanes become drier and particle ball will start to hook too early. To line back up with the pocket, a weaker ball may be selected. The ball of choice could be a reactive urethane with a higher RG and lower differential. This ball will skid further than the particle ball and be less aggressive down lane because of the lower differential, thus, creating a more desired reaction to reach the pocket.

If the lanes become even drier or there is extreme back ends present, perhaps an original urethane shell would help in getting lined back up with the pocket.

And as a typical league nights go, there's bound to be that pesky occasional 10-pin after what seems to be a great shot. Finally, the plastic ball becomes useful.