

SIX-PART SERIES EXCERPTED

NAIL STRUCTURE & PRODUCT CHEMISTRY



VERY TOUGH MATERIALS ARE BOTH STRONG AND FLEXIBLE – FIGURE 2.7

WHAT DO WE WANT OUR NAILS TO BE?

When talking about nails, many use words like strong, hard, tough, flexible or brittle, but do we really know what these terms mean? What's the difference between them? Some may think their meanings are obvious, but are they? Usually, clients don't really understand these terms and often misuse them. You should have a strong understanding of what they mean. This understanding will help you make the right choices for your client's nails and save you lots of time in repairs.

Material scientists are people who study the properties of many types of substances. They are very interested in what happens when you bend, twist, stretch, rub or crush different types of materials. They study everything from concrete and steel to diamonds and granite, to bones, wood and rubber. All of these are very different materials, but they have some things in common. All materials share some important properties. Material scientists seek to understand these properties. These unique

scientists dedicate their lives to learning why things break, split, melt, evaporate, discolour, dissolve or breakdown. Their quest is to learn more about the properties of all materials. For any solid substance there are five important properties that you must understand. These five properties are extremely important to nail plates and later you will learn that they are highly important to artificial nails. Let's take a look into the world of material science and find out why these properties are so important.

Strength is the ability to resist breaking under a heavy load. A bridge must be strong enough to hold all the crossing cars. In this case, the cars are the load. Tree branches must be strong to resist the load created by a heavy wind or so. Arms must be strong to pickup heavy loads. Nail plates need to be strong because we use them like tools. All the bending, picking, prying, scratching and clawing we do with our nails is proof of their strength. But strength isn't the only property that nails must possess. Steel is very strong, but we don't want our nails to be like steel! They would be too hard/ inflexible and we'd have to be careful

not to poke our own eyes out. It isn't enough for nail plates to be strong. Besides, it is possible for nail plates to be too strong. Nail plates are designed to break rather than let more serious damage occur. If the nail did not break, the matrix may be damaged or even destroyed by a hard blow. Nail strength must be in balance with other important properties.

Hardness is resistance to scratching or denting of a surface. Hardness is a property of the material's surface, (some incorrectly use this word when they really mean strength). Diamond is the hardest known substance. Diamond can easily scratch glass, topaz or quartz. But none of these materials can scratch the surface of a diamond. Their surfaces are much softer than diamond. The nail plate seems soft by comparison, but surface hardness is still very important. When nail plates are softer than normal, they are more easily scratched or stained. Softer plates have a tendency to peel or become pitted. Healthy nail plates need to be hard, but not too hard. When nail plates become too hard, they are more susceptible to shattering and splitting.

FROM THE SECOND EDITION OF

BY DOUG SCHOON PART 2

For example, overuse of nail hardening products may cause nail plates to become excessively hard, which leads to other types of damage. Some clients want their nails to be as 'hard as they can be', but really they wouldn't be happy if they got their wish. If you had the choice, which would you rather your nails be hard as rubber or hard as glass? Rubber is not nearly as 'hard' as glass, but most would rather their nails were more flexible, like rubber. Harder isn't always better!

Flexibility allows a substance to bend. Flexible materials bend to absorb a strong force or impact. Substances that resist bending will often suffer damaging cracks or breaks when impacted or when they bear a heavy load. Bones are a great example. Young children's bones are highly flexible, but they lose flexibility as they age. Elderly people's bones lose most of their flexibility, becoming brittle and easily broken. Sudden breaking, cracking or fracturing is a sign of brittleness. Normally, nail plates are highly flexible and will usually bend before reaching the breaking point. You will learn later that age, diet, health and many other factors can influence nail plate flexibility and brittleness. Repeated or long-term exposure to harsh cleaners and solvents can also make nail plates brittle and less flexible. Flexibility is also sometimes confused with strength. You can see from their definitions that they are quite different! Many things are very flexible, but have very little strength and the reverse is also true. Aluminum can pop-tops are an excellent example. They are very flexible, but bend them a few times and they will snap off. Environmental effects can also influence flexibility. Heat, cold, sunlight, moisture and wear, can all effect flexibility.

Toughness is the balanced combination of strength and flexibility. When these two important properties are in balance the result is a tough, durable material. The nylon fishing wire and plastic rings that hold together a six-pack of soda are examples of extremely tough materials. These substances will stretch a great deal before eventually breaking. But, they never get brittle or fracture. Hair and nail plates are also very tough materials. This is their most important property! What goes wrong when nails become brittle, snap or split too easily? If either strength or flexibility gets out of balance, then toughness is lost! Nail plates that are too flexible will lose strength. The reverse holds true also. Nail plates can become too strong and lose flexibility. Either way the nail plate will lose its inherent toughness and resistance to breakage. These two properties are closely linked. Nails must have both! Tough, healthy nails have the best of both worlds.

Wear is the ability to resist abrasion or rubbing. This is an important property for the nail plate. Even hard surfaces can be worn away by the right abrasives. Most nail files have a layer of silicon carbide glued to a hard backing or dense foam base. Silicon carbide is a crystalline mineral that is inexpensive and nearly as hard as diamonds. On a 1-10 scale, diamonds have a hardness of 10, while black silicon carbide

is a 9. Silicon carbide is nearly perfect as a material for nail files. Aluminum oxide is another abrasive used on files. This abrasive is white and a little softer. On the same scale it has a 7.5 hardness rating. Files made with silicon carbide are more aggressive and have a greater potential to be damaging. While the same grit aluminum oxide file is noticeably less aggressive. Abrasive files can quickly wear away the surface of the nail plate. That is how they work. Abrasives scratch away the surface keratin cells. Large particle or heavy grit files create larger scratches, while finer particles on small grit files will create tinier scratches. This explains why heavy grit abrasives can cause excessive thinning and damage to the nail plate. Heavy pressure can drive the scratches deeper. Under normal conditions the nail plate has very good wear properties. The free edge can be worn down, but not very easily. In later articles you'll learn this isn't always true for artificial nails. Toughness is the reason the nail plate is resistant to wear. Wear-resistant surfaces are often very tough.

TROUBLE-FREE TROUBLE SHOOTING

Trouble! Nobody likes it, nobody wants it and nail technicians get it. They're called problem nails. They cost time and money. Certain clients seem to have more trouble than others. It's a reality that every nail technician has to face. Luckily, there are always reasons for these nagging problems. Finding the reasons is the key to finding the solutions.

This is why it is so important for nail technicians to understand the meanings of terms like toughness, brittleness, durability, wear, hardness and strength. They aren't just words, they are concepts that can help you understand many nail problems. These concepts will help troubleshoot the most perplexing problems and give you answers to your client's most challenging questions. If you learn about these important properties and use your knowledge, it will save you time, frustration and lots and lots of money.

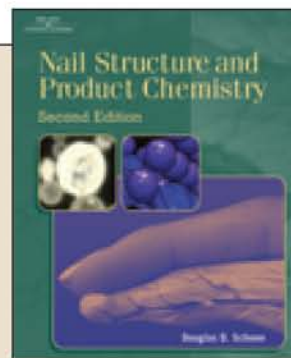
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Figure 2.7 is courtesy of Paul Rollins, Laguna Hills, California
My portrait is courtesy of Paul Rollins, Laguna Hills, California



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Doug Schoon has over 30 years of scientific experience, a Master's degree in Organic Chemistry and is considered to be the leading research scientist in his field. His unique expertise focuses on the science of both the natural and artificial nail. He is a well-known and respected author, as well as an internationally renowned lecturer and educator. Mr Schoon is a strong advocate for salon safety. As co-chair of the Nail Manufacturers Council, he frequently represents the entire nail industry on scientific and technical issues in Europe, Canada and the USA and is often called to serve as an expert witness in legal cases involving cosmetic safety and health. Additionally, dermatologists frequently call Mr Schoon to assist in writing books and scientific papers concerning fingernails. For the last 16 years he has led the scientific research team for Creative Nail Design, Inc. and presently serves as its vice president of Science and Technology. He currently resides in Dana Point, California.



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PART 3 IN SCRATCH DECEMBER

UNDERSTANDING FILING AND PUNCHING TECHNIQUES