What Do We Want Our Nails To Be?

Adapted from Nail Structure and Product Chemistry, 2nd Edition by Doug Schoon.

Many people use words like strong, hard, tough, flexible or brittle to describe their nails, but what do these terms really mean? Many misunderstand the meanings of these terms and clients often misuse them, as well. Nail professionals should understand these terms; since this 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 like to twist, stretch, rub and crush things; studying everything from concrete and steel to diamonds and granite, to bones, wood and rubber. Each has very different materials, but they have some things in common because all materials share certain properties. Material scientists seek to understand these properties and dedicate their lives to learning why things break, split, melt, evaporate, discolor, and dissolve, breakdown or whatever. Their quest is to learn more about the properties of all materials and we can learn from what they know.

For any solid substance there are five important properties to understand because they are extremely important to both natural nails, as well as, artificial nail coatings of all types. Let's glimpse into the world of a material scientist 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 heavy wind or so. Arms must be strong to pick up 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 nail plates must possess. Steel is very strong, but we don't want our nails to be like steel; they'd be hard/inflexible and we may poke our eyes out. Nail plates can't just be strong and it is possible for them to be <u>too strong</u>. Nail plates are designed to break rather than let more serious damage occur. If the nail plate did not break, the matrix may be damaged or even destroyed by a hard blow. So strength isn't all a nail plate needs.

Hardness is resistance to scratching or denting of a surface. Some incorrectly use this word when they really mean strength, but very weak substances can be hard; e.g. glass. 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. Why? Each of them has a surface that is much softer than diamond. In comparison, the nail plate is much softer, but its surface hardness is 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, especially when gouged or scraped to remove artificial nail coatings. 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. For example, overuse of certain nail hardening products may cause nail plates to become excessively or overly hardened and that can leads to brittleness, cracking, shatters, splitting, etc. Clients may think they want nails that are as "hard as they can be", but they'd be unhappy 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, rather than to crack or break. Things that resist bending can be damaged when impacted or when a heavy load is applied. 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 more easily broken. Sudden breaking, cracking or fracturing is a sign of brittleness. Normally, nail plates are highly flexible and will usually bend rather than break. Age, diet, health, exposure to water 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. Don't confuse flexibility with strength- 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.

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. That's one of its most important properties! Why do nails become brittle or begin to snap or split easily? This indicates that either strength or flexibility is out of balance. When this happens, toughness is lost! Nail plates that are too flexible will lose strength; that are too strong will lose their flexibility. Either will result in the nail plate losing 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 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. Aluminum oxide is a white, softer abrasive material. 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 damage the nail plate than aluminum oxide. It is important to note that the same grit size of aluminum oxide on a file is noticeably less aggressive silicon carbide. 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 and increase nail thinning. Under normal conditions the nail plate has very good wear properties, but it can't stand up against an abrasive under a heavy hand. The free edge can also be worn down, but not very easily. Interestingly, nail plates that have greater toughness are also more resistant to wear. Wear-resistant surfaces are often very tough.

I hope that by having a deeper understand of these terms and how they apply to the natural nail; nail technicians and clients alike can use this knowledge to keep nails in top shape.

If you want more information about the natural nail, my book Nail Structure and Product Chemistry, 2nd Edition is a an excellent resource, as is my DVD, Doug Schoon's Brain in 3D, both re available at http://www.schoonscientific.com/purchase-books-dvd.html

Newly revised 4/15/2014