Best's Insurance Law Podcast

How Materials Science Impacts Insurance Claims - Episode #202

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Guest Expert: Dr. David Riegner from S-E-A
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John Czuba: Welcome to "Best's Insurance Law Podcast," the broadcast about timely and important legal issues affecting the insurance industry. I'm John Czuba, Managing Editor of *Best's Insurance Professional Resources*.

We're very pleased to have with us today Dr. David Riegner from Qualified Member expert service provider, S-E-A. David has experience in the investigation of electrical power quality, electrical controls, household appliances, and consumer electronics.

He completed his Master of Sciences and Doctor of Philosophy degrees in material science at The Ohio State University. After earning his PhD, David served as a post-doctoral researcher and lecturer in the Ohio State Department of Material Science and Engineering.

David is a member of the ASM Failure Analysis Society, as well as the Association for Materials Protection and Performance, AMPP, and has volunteered time to local STEM outreach organizations.

At S-E-A, David works in conjunction with other disciplines and leads materials focused investigations, primarily focusing on fractography, which is the study of fracture surfaces, characterization and identification of materials, corrosion and environmental effects imaging.

This skillset allows the sequence of events leading up to and including a failure to be analyzed within the context of the observed physical damage. Other interesting capacities include development and execution of testing, product evaluation, and vehicle accident damage analysis.

David, we're very pleased to have you with us today.

David Riegner: Thanks for having me, John. I'm excited to be here.

John: Today's discussion is on material science and its impact on insurance claims. David, for our first question today, what is material science and how does it fit into forensic investigation?

David: Yeah, so material science is the branch of science and engineering that connects the behavior of atoms and molecules, the very, very small building blocks that make up the material to their behavior at human scales**.**

If we want to understand how a steel beam is going to perform, material science is going to tell you that the individual atoms of iron and carbon that make up that beam, their behavior informs the behavior of the entire beam.

This matters in forensic investigations because when a material fails the way that those atoms and molecules behave while they fail, leaves behind evidence that we can find and analyze, and using that evidence, we can determine many of the circumstances surrounding and causing the failure.

A good example of this is if you want to imagine a big engineering failure, like a building collapse, a plane crash, or a good example would be the Challenger Space Shuttle explosion. You go out in the field and you find as many pieces as you possibly can, you bring all those pieces back to a warehouse.

You've probably seen these photos where they lay out all the broken pieces of the machine or plane or space shuttle in a warehouse, and a material scientist would be involved in that. They would look at each of those pieces and try and figure out what order or sequence the failure actually took as the structure or vehicle started to fall apart.

John: David, how exactly do you do that and what technology and methodologies do you utilize along the way?

David: For material science, imaging and microscopy is just a huge part of what we do. We're using a microscope to look at fracture surfaces. When the material breaks, it leaves behind patterns on the fracture surface that tell you the direction of failure, and often the rate.

A fracture of a part that breaks very quickly is going to look different than a part that breaks in what we call fatigue, where there's multiple small loads over a long period of time. We're using various different kinds of microscopes. One of the very powerful tools is called a scanning electron microscope.

The SEM doesn't even use light to make its image. It uses electrons. That matters because you're actually getting fundamentally different information. One of the very cool things the SEM can do is you can look at a part in the SEM and actually determine what atom type you are looking at.

You can use another technique to determine, OK, this is iron, this is aluminum, this is titanium. Obviously, that's very valuable information in a forensic investigation where you may be trying to figure out what it is you're even looking at, let alone why it failed.

Identifying the materials, identifying the fracture surfaces and the patterns left behind is all very important, obviously in forensics, and material scientists are very good and well versed and have the expertise to do that.

John: David, why do materials fail?

David: That's one of my favorite questions and I love talking about this because it's maybe something that gets taken for granted a little bit outside of forensics. Materials don't really fail on their own. If I take a piece of aluminum and just set it on the table, it's pretty unlikely that it's going to fail.

It's once it gets put into service that things start to fail. Is that block of aluminum sitting on the table, is it interacting with chemicals that it shouldn't be interacting with? Are there people interacting with it? Is it being used in a manner that it really shouldn't be used for?

Those decisions all get made even before a part even gets put into service. When you're working on a forensic investigation, you are trying to unpack and analyze those decisions that were made days, weeks, months, years before you even were aware that this investigation was going to happen.

Materials fail in application, and they fail in application because someone somewhere else, not you, made a decision about what that part should be made out of, how it should be made. In any forensic investigation, there's always some materials consideration. Sometimes that material's consideration is you rule out the materials being an issue right away.

Sometimes as you dig deeper and go through the investigation, you start to realize that materials are maybe the fundamental problem with what's going on in a particular situation. A good example of this is in vehicle accidents. Sometimes the way that the vehicle looks after an accident or something that I do often is a wheel off case where a wheel actually comes free from the vehicle.

It's very important to know whether or not that wheel came off before or after a crash. If the wheel came off before the crash, people are going to be interested in knowing whether or not it caused the crash. I would work with a vehicle accident reconstruction expert to determine that.

Sometimes when a vehicle gets in a crash, the crash itself breaks the wheel off. That's a good example of determining whether or not the materials of the wheel are a cause or a victim in an accident.

John: David, why are materials part of every forensic investigation and how and when do material analysts get pulled into an investigation?

David: This kind of goes with what we were just talking about, which is that materials fail when they're being used. At S-E-A we have many different disciplines, many different groups that work on different kinds of incidents.

I'll get a call all the time. They'll just say, "Hey, I'm looking at this and it doesn't look quite right to me. Can you just take a look at it under the microscope? Or can you go through some design drawings and see what material this is supposed to be and help me figure out whether or not what I'm looking at makes any sense?"

Those are some of my favorite cases to work on, is when I'm being pulled in by other disciplines to help them tie up loose ends. One of the main things that we do is we try to figure out what the "mode" of failure is, because that's what other investigators within S-E-A are going to be interested in knowing.

When I talk about a mode of failure, I'm talking about things like was it overloaded? Or was it fatigue? Like I mentioned before, which is many small loads causing a failure versus overload, which would be one big failure.

If you think about things like a water loss on maybe a sprinkler pipe, we'd be interested in knowing whether or not that pipe burst due to over pressure or was there a freeze? Because a freeze is going to leave behind different information than an over pressure event where maybe a pump kicks on and the pressure inside the pipe actually gets too high for the material.

Materials are a part of every forensic investigation because nearly all forensic investigations involve at least one material failure. You can think again about vehicles. You can think about water losses. You can think about collisions or impacts, all that stuff. The way that the materials behave is important.

When you are looking at a warehouse full of broken plane parts, or in our case, often a fire scene would be something that we'd be working on where we have dozens or hundreds of evidence items to consider. Materials science can really help narrow down which of those parts matter and which don't.

John: You mentioned quite a few incidents. What kind of cases do you typically get pulled into at S-E-A?

David: That's where working at a place like S-E-A has been a lot of fun for me as there are so many different disciplines here. I've had the opportunity to work on vehicles. I've done amusement park rides. On top of that I do just an incredible amount of insurance work where it may be water loss in a home, or commercial water loss from a small appliance.

Funny. We do a lot of coffee makers. We do a lot of refrigerator ice makers that leak. The fundamental scientific principles are the same. Whether you're looking at a coffee maker that leaked and caused a water loss, versus a fatal vehicle accident, the process isn't any different.

That's where being a material scientist under the roof of a place like S-E-A has been super fun for me because the things I get to do, it's never the same. I'm always doing a little bit of something different that I haven't seen before.

Applying those same principles of understanding atomic behavior, understanding fracture surfaces, understanding decision making processes that lead to these materials failures. That's been a really great process to be pulled into.

I guess the answer to that question is I do a little bit of everything and that's maybe the best part of the job.

John: David, one final question today. How does this relate directly to insurance claims and litigation?

David: I think it's super important to insurance claims because that question of whether or not a particular part is a victim or a cause, is the core question that insurance claims need to answer. A decent amount of the work I do may also be involved directly with the language in a policy.

Some of these exceptions that have very specific wording for, "are we going to pay it or are we going to deny it?", may hinge on one or two words in a policy somewhere. The insurance company has a hugely vested interest to know that they have scientific basis or objective support for making that coverage decision.

That's where materials science can make a huge difference. I can look at a part or I can look at a few parts and come to some conclusion about why they failed, when they failed, how they failed. Often that can have a direct impact on the decision making process from a policy standpoint.

When it comes to insurance stuff, I think it's really important to have someone look at the part that really understands that nuance of not just whether or not the part failed, but why it failed and how it failed, and what the other circumstances that may have caused it to fail really are.

John: David, thanks so much for joining us today.

David: Hey, thanks John. I appreciate it.

John: You've just listened to Dr. David Riegner from expert service provider, S-E-A. Special thanks to today's producer, Frank Vowinkel. Thank you all for joining us for "Best's Insurance Law Podcast." To subscribe to this audio program, go to our web page, www.ambest.com/claimsresource. If you have any suggestions for a future topic regarding an insurance law case or issue, please email us at lawpodcast@ambest.com.

I'm John Czuba, and now this message.

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