

Analyze That episode transcript

Faster Decisions, Better Data: Advances in XRF for Slurry Analysis

Hello and welcome to another edition of Analyze That by Thermo Fisher Scientific. I'm Kevin Gordon.

I'll be your host in today's podcast. And today we are joined by Tom Strombotne. He's our Senior Minerals Application Specialist. Thanks for joining, Tom.

Hey, happy to be here, Kevin.

Yeah, thanks. So, you know, just recently Thermo Fisher released a new product, an exciting new product called the MEP 400. Can you tell us a little bit about that from a high level? Sure.

The MEP means multi-element probe, and this is an immersion probe XRF elemental analyzer for slurries, primarily slurries. It is the fourth generation of this product technology that we pioneered many, many years ago. The most recent release was the 300, which was a liquid nitrogen-free version of our immersion probe. And the MEP400 continues that innovation and advancement of technology by removing the need for isotopes. We've integrated in a low-power air-cooled X-ray tube as the excitation source for the probe. So now we have LN-free, isotope-free immersion probe system, which can be... acquired is an upgrade if you're an existing user.

And obviously in our new version of our products, the Anstat 430 and MSA 430 that use this technology. And one of the exciting things that we were able to do with this rollout of isotope-free is we were also able to put in the latest digital signal processing, pulse processing and X-ray detector technology into this compact immersion probe format and that is an advancement over what we put in about 10 years ago in the MEP-300 so we have the latest very fast very high resolution very efficient digital signal processing a large surface area detector. And coupled with a very close geometry of the system in the immersion probe format, it means we have a very, very efficient X-ray detection system.

We use energy dispersive EDXRF in this technology, and we can measure many elements all simultaneously. So it's called simultaneously multi-element analysis. So that's kind of a sort of introduction to it. Yeah, so I think some of the biggest feature is customers no longer have to use an isotope-based system. And the MEP-400, obviously, is isotope-free. So that's a huge advantage just in that. But as you know, we focus on a lot of process control.

So is there any difference in terms of the speed of measurement versus the...isotope based MEP 300. And, you know, obviously when you're in process control, you want those fast measurements so you can make quick decisions.

Is there any difference in that? Yeah, so there sure is, Kevin, and another one of the exciting things about this new product. Because of the advanced detector and signal processing, coupled with the low-power x-ray, air-cooled x-ray tube, we have a very high... x-ray flux instant x-ray beam exciting the sample looking at a relatively large spot size through the probe window into the moving sample slurry sample and our count rates have dramatically increased by several factors over the isotope based system one of the cool things about using x-ray tubes is you can adjust the amount of x-ray that they are emitting by changing the power of the X-ray tube. So we have that optimized to give us good tube life, but also very, very high count rate. So specifically to your question about measuring time, what before with an isotope system, let's say in a low grade, very low grade, low solids, so low concentration and slurry process stream, we might have to measure for... three, four, five minutes in some cases, if it's really low solids. Now that that pounding time can be reduced by at least a factor of four without impacting the accuracy. So now we can truly talk about minute by minute assays in almost all cases for base metal mineral recovery systems.

And let's say low grade copper, low grade copper moly and so on. And then when we talk about using the MEP-400 in the MSA, the multi-stream analyzer, now we can reduce cycle times. Maybe you're measuring 6, 8, 10 streams with a single analyzer. That amounts to a long cycle time, which would impact your ability to make process control decisions. So now if you have a MEP 300, MSA 300 series or earlier upgrading to a 400 will allow you to reduce your cycle time in some cases very substantially. So you could easily do a minute on every stream for the most part.

So not only are we looking at a situation where a customer could be isotope free, but they're also getting faster measurements and still even better accuracy than previous version, which is going to be incredibly important for a dynamic processing.

Right. Yeah, it's really exciting about that, and we've been working with – the industry is in the process of adopting some new flotation technologies. It has been for a while, but it's really started to get hold, specifically the Jameson cell, Jameson concentrator, where you have these pneumatic flotation cells with very fast reaction time. You no longer have this luxury of having big tank cells that have mixing time and tend to homogenize your feed out a little bit and reduce variability and have maybe 15, 20, 30, 40-minute residence time. We all grew up with putting in multi-stream systems that can service those quite well, but they leverage these long residence times, so you don't need a quick cycle time. With these new pneumatic cells, we're talking resident times of just a few minutes.

So you really need that rapid update interval to best respond to changes and actually take advantage of those very highly controllable pneumatic cell separation flotation cell technologies. Now you don't have this big mixing vessel in long residence time. You need to know what's coming through the cell and make a fast decision on how to accommodate it. And you'll also see greater variability from your feed. That was a little bit masked by the mixing going on in these big systems. So it's a real advantage there. And I think it fits well with these new technologies for separation that are coming in too.

We're seeing this both in brownfield projects, brownfield retrofit projects, and also new plant designs.

Okay. So you mentioned multi-element analysis. So how does the system handle simultaneously multi-elemental analysis and what's the advantages that provides for the end user?

I mentioned we use energy dispersive detection systems. So it's a large surface area, silicon drift detector, which is, you can think of it as an image sensor for XRF. And it has many detectors in it. And you think of those as pixels in a video camera. Each one of those is its own little X-ray detector and processes an event. So X-ray event is captured x-ray photon being captured by one of those pixels in the silicon drift detector is then processed and that energy is converted to an electron charge and the electron charge is converted into an equivalent voltage pulse whose amplitude is proportional to the number of electrons which is proportional to the energy of the x-ray so by Counting those events and quantifying the amplitude of the pulse produced, we can build a spectrum.

So you put that data in a histogram and build along the x-axis the energy of the x-ray and then the vertical axis is the number of events that builds a spectrum, a histogram. And so we can see how many events happen at a certain x-ray energy. And that tells us what elements are present because we know from XRF theory that different elements have different emission lines, different energies, and we can accumulate a whole spectrum. So from generally speaking in slurry from calcium to uranium, we can detect elements with this system and provide analysis of all the elements that are present in that sample as long as the concentration is above the detection limit of the system.

So one of the really exciting things that we learned with this new system, with the more advanced detector and signal processing, is even compared to our earlier MEP-300 system, which also had a large surface area silicon drift detector and digital signal processing, we were able to see minor element values much better, much more clearly. We have a lot more counts that helps from the x-ray tubes.

But just for example, where we couldn't see a barium peak before, we now can. Now this is a minor element in a typical copper ore. But in our test site, we were able to see barium quite nicely and build a good calibration for barium. And that's quite useful as a indicator of either ore type or can be some indicator of something that would consume reagents, for example, that then you could accommodate for. So in addition to copper, iron, moly, we can see these lighter elements now. I should correct myself. That was bismuth, not barium. The case, that was bismuth, but barium is another good example.

We can pick up arsenic, things like this, iron moly or lead zinc. lead, zinc, copper, iron, and then one day you're in your plant troubleshooting things, you're looking at the live spectrum on the feed. You can identify what elements are causing those peaks. You can set the analyzer up to measure those peak intensities and actually build calibrations for them. And you don't have to pay extra money to do that. You don't have to go out and buy another channel to measure that element. It's built into

the instrument. So this EDXRF technology, multiple elements, simultaneous measurement with a low power X-ray tube, very high count rate, very good energy resolution, really brings a lot of value to the end users who have complex problems, mineralogy changes, and want to start looking at some of the minor peaks that may be affecting their indicative of mineralogy may be affecting their grinding or flotation circuit.

Okay, good. Well, it certainly sounds like the MEP-400 is a very good product, a very exciting product, and it's going to bring a lot to the end user. You know, kind of as a wrap-up, we think about the MEP-400 as isotope-free, faster measurement, increased accuracy and precision, and to your point, in terms of the lighter elements of ability to see some of those lighter elements. So it's very exciting.

Yeah, the minor elements are still limited to about calcium in slurry. Anything below that, the self-absorption of XRF in slurry is too much to get a signal out of the slurry. So as before, sulfur, silica or magnesium, those types of elements are not addressable by XRF. If you want to go after those in real time, direct, we have a PGNAA slurry analyzer for that. And then some of the other really exciting aspects of this technology is that we have built-in internal reference.

So if you're a user of our earlier systems, you know, occasionally they had to be extracted in a sample and put offline to do a standardization. That would take many hours and was done, let's say, every 90 days or something to account for source decay. That's no longer necessary. A lot of safety built into the instrument now because of this, the system extracts and it has a built-in shutter to it. It has safety and locks. So now if you're servicing the equipment, you need to clean the floor window. You press a button, the hoist goes off. It's indicated by a semaphore LED system. It's perfectly safe, clean the window with your acid wash or wipe it down or change the window it takes less than five minutes there's absolutely no exposure to any radiation whatsoever so it's very safe you don't have any disposal issues anymore special permitting or licensing issues that the licensing of permitting really of industrial x-ray systems using x-ray tubes is much, much simpler than having possessing isotopes. So that reduces a lot of burden on the part of the end user's safety group and also the end users.

And then on top of that, the internals of the probe can be replaced in the field. So if, for example, the detector, the X-ray tube or the internal electronics need to be replaced, you can have those modules spare on your shelf back in the warehouse of the instrument shop. You bring your probe to the instrument shop. You can replace these items in the field with a little bit of training from our service engineers, or you can have our service engineer come out and do the job to replace the x-ray tube. Now, x-ray tubes, unlike isotopes, they can fail because they're an electronic device. Basically, an X-ray tube is like a light bulb. So like a light bulb, you turn it on and leave it on. Eventually, the filament burns out and you need to replace it. The same is true for an X-ray tube. What do we do to enhance the life of the X-ray tube? Extend it. Now, we learned many years ago with the GammaMetrix X-ray 1600 system which use low-power air-cooled x-ray tube, how to get the amount of life out of these compact x-ray sources. So think of it as if you buy a 100-watt x-ray tube and you put it on your porch and you turn it on at full power, eventually you're going to

have to replace it. That x-ray tube, let's say you run it at one watt instead of 100 watts, it's going to last a hell of a lot longer. And that's exactly what we're doing. our approach for the MEP-400. We're operating a higher power X-ray tube at very, very low power, which we can afford to do. We have a large surface area detector, very fast signal processing, and very, very compact geometry. So it's a very efficient system, and we expect to get excellent life out of the X-ray tubes based on our previous experience using this technology. Very good.

All exciting stuff. Kind of like I said before, the MEP-400 sounds like it's very exciting, and I think a lot of end users are going to be very happy using the MEP-400, and we look forward to hearing more about the MEP-400 in the future.

Tom, I really appreciate you joining us today. Hope to have you back on future Analyze That podcast by Thermo Fisher Scientific.

It's a pleasure. Thanks.