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INFRA^MATION

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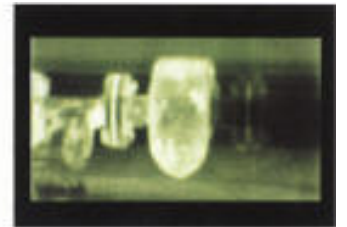
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Welcome [top]

Hi { { user("firstname")} },

Happy St. Patricks day!

St. Patrick is the patron saint of engineers and thermographers too! Remember the AGA 110 Thermovision "Infragreen" thermal imaging units of the early 1980's?



We have a [feature](#) this month, a link to view past issues of our newsletter. Enjoy!

Click [here](#) to download a pdf version of this newsletter.

Until next month,

Gary Orlove,
Editor and Publisher



Coffee Roasting at Home [top]



Dr. Bob Madding
Director, ITC

Two things steered me towards roasting coffee at home. The first is I really love coffee, but I am not supposed to drink a lot of it. So, when I drink it, I want to drink really good coffee. The second factor is I am cheap. Perhaps frugal is a better word. Designer coffee houses such as Starbucks serve a pretty good product, but you pay for it. And if you buy fresh roasted coffee, it too is expensive. I have come to believe also that the phrase “fresh roast beans” is an oxymoron. Roasted coffee beans stay fresh for about two weeks, tops. You can vacuum pack it, you can put it in the freezer, you still have about two weeks. Can you drink month-old coffee? Sure, but it won't taste as good as week-old coffee. How long does this stuff sit on the shelf before you buy it? Then I found out green (unroasted) coffee beans stay fresh for up to two years! And they are less than half the price of roasted beans!

Surfing the web really paid off. Turns out there are several places that sell green coffee beans and roasting supplies for the small operation and pocketbook to match. My favorite, and this is a shameless, unsolicited plug, is www.sweetmarias.com. They describe where the coffee came from, what it tastes like and how to roast it for best results. I started with a small roaster with about 2 oz capacity and now roast ½ pound at a time. Compare to commercial roasters at coffee shops that roast 25 pounds per batch.

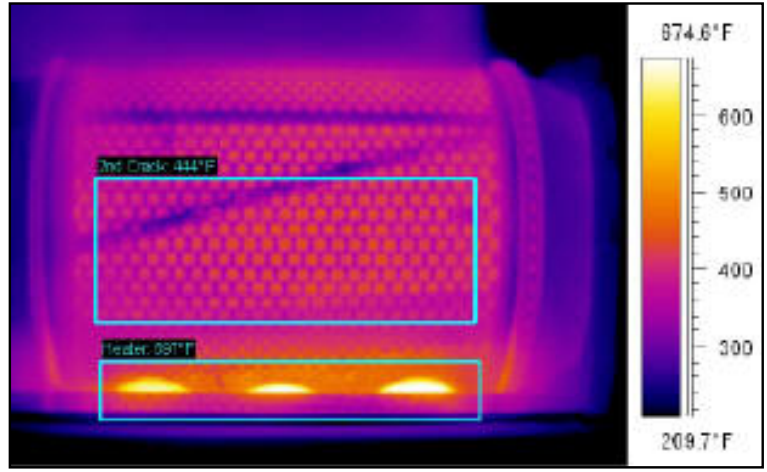
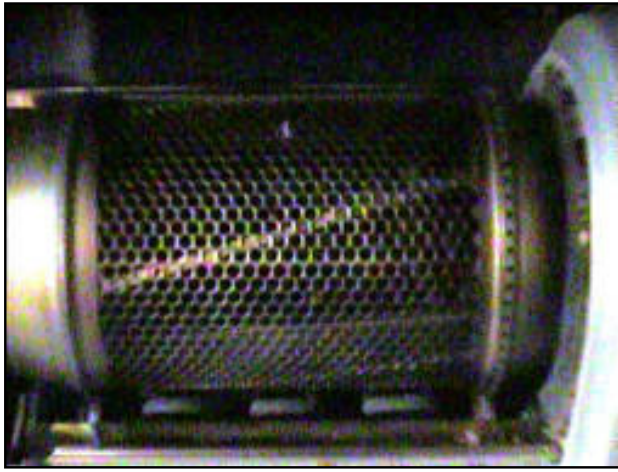
So, what does hobby coffee roasting have to do with IR thermography? In a word: temperature. Coffee beans need to be brought to the right temperature in the right amount of time to give a flavorful product. Different varieties of beans roast differently, are of a different size and so on. Coffee roaster technology has evolved to provide the right amount of heat to all the beans efficiently, at least in theory. One methodology is a drum roaster such as the ½ lb. capacity Alpenröst I use shown in the figure below.

The photo on the left shows the roaster with its access door open. Inside is a mesh drum that rotates to stir the coffee beans. At the end of the cooling cycle, the drum reverses direction allowing internal vanes to dump the roasted beans into a container on the left side. At the bottom is an electric heater. The exhaust on the right allows air drawn in from the left to escape. When the cooling cycle is reached, an internal gate opens and a large volume of air is drawn through by a blower. Invariably, smoke is produced by this or any other roaster. Good ventilation is necessary for home roasting. I put my roaster in a clean fireplace and vent up the chimney in the winter and roast outside on the deck in the summer.

The infrared image on the right shows the exterior of the roaster in operation with the door closed. There is a gradient from left to right indicating direction of air flow through the machine.



The infrared image below shows the coffee inside the drum at the beginning of the cooling cycle to estimate the final roast temperature. According to Davids (see reference below), if the internal bean temperature stays below 390°F, “the flavor oils stay undeveloped and the coffee will taste grassy, sour and will be without aroma.” Should the internal temperature soar above 480°F, “most of the flavor oils will have been burned out of the bean and the woody parts of the bean itself may be charred. Such coffee tastes thin-bodied, burned and industrial.” Within this 90F° span, the coffee roast ranges from a light “Cinnamon” to a “Dark French”.



The coffee used for this test was a Kenya AA Kiawamururu Auction Lot '02 roasted about 15 seconds into the "second crack" (see below). The resulting temperature was about 444°F, yielding a "full city" roast, just the way we like it at the ITC. In lieu of temperature measurement, coffee roasters rely on their senses of color, smell, time and hearing, yes hearing. The Alpenröst has no viewing capability short of opening the door which cannot be done without compromising the roast. Sound and experience are the keys. Between 380°F and 400°F, the "first crack" occurs. This sounds a lot like popping corn, indicating the onset of pyrolysis, or the internal transformation of the bean. Stopping now will give the lightest roast one would want. For those who prefer a darker roast, we often wait until the onset of the "second crack" which sounds a lot like frying bacon. This occurs at a temperature between 415°F and 435°F. Roasts beyond second crack are the darker roasts. Experience with individual coffee types and the roaster play a key role in success. I keep records of what coffee I roast, how long I roast it and what the results were.

Though the home coffee roaster will never buy an infrared camera to check the process, industrial roasters have done so. Infrared thermography has been used to evaluate coffee roaster afterburners, finding such problems as refractory failure, flame distribution problems, air/fuel ratio problems and so on. In terms of process control, thermography may eventually play a role through use of automated IR. If an IR camera could readily view the coffee beans while roasting, what better way to evaluate the thermal conditions? IR imagery can readily capture thousands of swirling coffee beans in the act, a trick not possible with thermocouples.

For further reading, a great reference on home coffee roasting for the beginner is Kenneth Davids' [Home Coffee Roasting](#). He discusses history and how-to in a clear, concise manner. I have been roasting for four years now, and I feel like there is still so much more to learn about the fascinating world of coffee. And I think infrared thermography can and will play a much larger role in coffee roasting machine design, production and maintenance.

Meet the Staff - Jay Bowen [\[top\]](#)



Jay Bowen
Instructor – ITC Level II

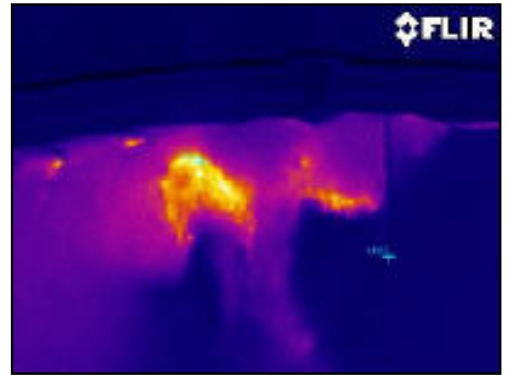
The ITC welcomes Jay Bowen, our newest instructor. Jay has been involved in the electrical trades since 1977 and has an Associates Degree in Electronics Technology. Jay holds a Wisconsin Masters certificate and a State designer's license in electrical systems.

He has been using infrared thermography as a condition monitoring tool since the mid-90s. He recently led Encompass Services Corp. CM Programs, teaching and expanding service groups' roles by offering services including thermography inspections across the U.S. Jay developed and taught classes in thermography, motor control, power quality, instrumentation, and PLC.

Last Month's Brainteaser [\[top\]](#)

Last month's Brainteaser evoked a plethora of responses ranging from an elephant's ear to infected tooth to a volcano, but nobody guessed the right explanation.

These images show an old coal pile that developed hot spots due to oxidation buried deep in the pile. The hot areas probably started by spontaneous combustion, one of the most frequent reasons for coal fires. The term 'spontaneous combustion' means that coal can start to burn without any recognizable outer influence. It is caused by coals ability to react with oxygen contained in the air. As a result of the oxidation process



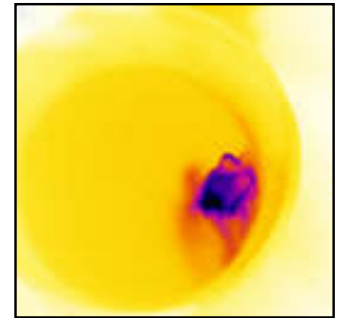
the temperature of the coal starts to rise. If the temperature reaches a certain temperature noxious gases are produced such as carbon dioxide. Finally, if the temperature still continues to rise the coal reaches the flash point and starts to burn.

This image shows a bulldozer pushing out the hot spots. Congratulations to Marty Nelson from JEA in Jacksonville, FL who took the thermograms and stumped us all.

Brainteaser of the Month [\[top\]](#)

Here is this month's brainteaser. First reader to email me with the correct explanation wins \$20 in Infrabucks. Please put "**Brainteaser**" as the subject of the message.

[Click here to email your guess](#)



Past Issues [\[top\]](#)

Click the links below to view past issues of this newsletter:

[All past issues from February 2000 December 2002](#)

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Upcoming Classes [\[top\]](#)

Click the links below to see our latest course calendars.

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[EurAsia](#)

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About the Infrared Training Center [\[top\]](#)

The Infrared Training Center offers training and certification in all aspects of infrared thermography use. Our world-class training facilities are located near Boston, Massachusetts, USA and Stockholm, Sweden and have the world's most extensive hands on laboratories for infrared applications. Please join us in exploring the fascinating world of the infrared!

Your comments and suggestions about this newsletter are welcomed and encouraged. If you have an interesting application or case study to share, we encourage you to submit it for publication. **Published articles earn credit towards recertification.**

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