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Some Comments in Praise of Industrial Applications

Gary Breed
Editorial Director



One of the less-visible areas of high frequency technology is the realm of industry, which has many uses for RF power, sensors, controls and measurements. While most of us are aware that this family of applications exists, it is a subject rarely covered by news media intended for the general public.

Industrial RF power applications have been around for a long time. I learned about them while still in college; I got to know a local electronics technician whose job was maintaining the RF heating equipment used to cure glue at a piano factory. He also informed me that some of the wood they used was dried with RF heating rather than a conventional kiln. This personal introduction certainly raised my awareness of industrial RF.

It is interesting to note that current engineered wood products such as plywood, particleboard and waferboard continue to use RF heating to quickly cure the glues and resins that bind the wood fibers together. The same basic technique is also used to enable the leading edge of solid-state technology—curing the adhesives that attach thin silicon wafers to a supporting substrate. The thinned wafers are required to improve performance, since silicon is not an optimum dielectric for high frequency/high speed integrated circuits.

Another recent RF heating application is killing parasitic microbes and insects in some vegetables, fruits and nuts to avoid spreading infestation and for reducing harmful bacteria and other pathogens. Many of these techniques are still being studied, but RF techniques are already replacing some chemical insecticides that are difficult to wash off and must have the residue collected and disposed of properly. The new RF techniques are being used both for food processing and for treatment of seed stocks.

Also in the biological realm is a potential future application in biofuels. You may have read about switchgrass as an alternative to corn for making ethanol. Recent technical papers show that using RF heating during the pre-treatment stages significantly accelerates the process of breaking down switchgrass' more complex sugars and cellulose compounds.

A medical application that uses common industrial heating technology has gotten coverage in the general news media. John Kansius combined his ham radio-based understanding of RF with recent nanotechnology develop-

ments to create a potential treatment for cancer. Conductive nanoparticles absorb much more RF energy than tissue, and the nanoparticles can be designed so they bind to cancer cells in much greater numbers than elsewhere in the body. This allows localized concentration of ordinary ISM band RF heating power, raising the temperature of the cancer growth to a lethal level. Clinical trials are being developed to test this treatment.

Another major current use of RF power is in metal deposition (sputtering). All those flat-screen glass panels for computers and television require metallization, deposited with equipment that uses RF to vaporize the metal. The coating that limits light transmission through insulating glass is delivered in the same way.

Sensors and Controls

It's not just power—among other applications of RF/microwave energy in industry are sensors. Using techniques related to radar, sonar and ultrasonics, sensors have been in use for many years to monitor fluids, gases and vibration. The most entertaining application I learned about some years ago was monitoring the density of corn flakes in air as they were blown through ductwork at a breakfast cereal factory. Perhaps this is still the way they are transported!

Today, we have sensors for fluid levels in storage tanks, mm-wave radar to position objects for fabrication, and many other functions that control or monitor industrial processes. The newest technique is wireless networking of these sensors with their associated machine control, material handling and

inventory control systems.

The factory floor is an excellent place for real-time networking. Process control, quality management, retooling, and all the other typical activities in a manufacturing plant benefit from fast, flexible communications and control systems. WLAN, ZigBee and IEEE 802.15, as well as proprietary systems, are being used to carry the data and control.

The list of other industrial uses is quite lengthy. For example, I haven't even mentioned analytical uses such as materials research and inspection of bonds and layers that go well beyond typical sensor technologies. Hopefully, I've made it clear that industrial use of high frequency technology is an important growth area, despite its lack of publicity.