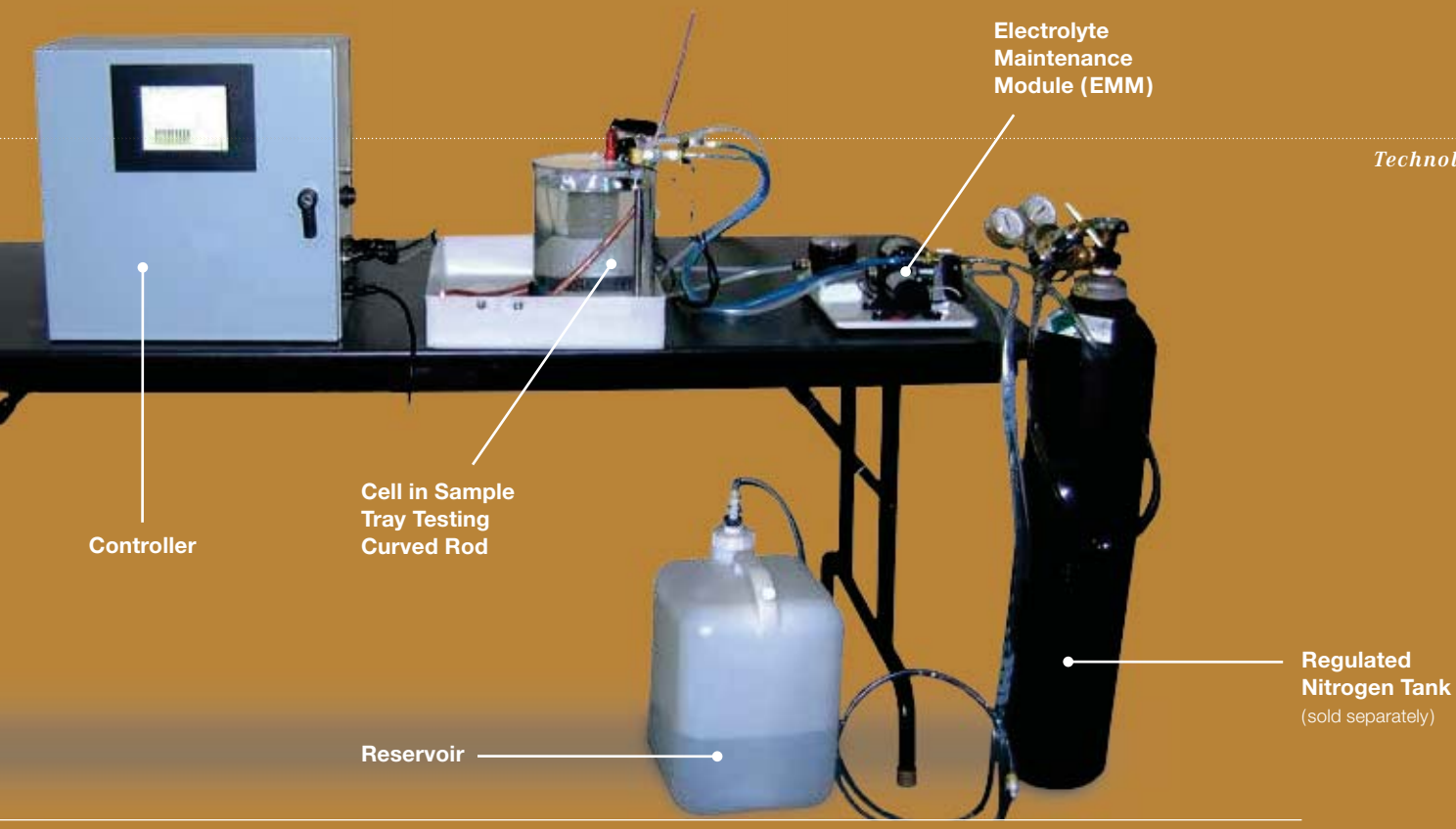
Measuring Surface Oxides on Copper



Issue 4 of the Properzi Tech News discussed the origin of copper oxides that are present on continuously cast rod, and described several industrial processes that help to remove or diminish this deleterious constituent. In addition, it briefly summarized a few basic principles of the test method that measures surface oxide thickness, and introduced to the marketplace a new surface oxide tester (SOT) that is being distributed by Continuus-Properzi. The present article describes in greater detail many features, functions, and benefits of this SOT and recommends procedures that should be adopted during testing in order to obtain more accurate and reproducible results.

The aforementioned electrochemical tester employs an electrolysis cell that contains an inert anode and a reference electrode that are electrically connected to the rod sample (cathode) via liquid electrolyte. Other components include a controller that contains the control firmware for all basic functions, an electrolyte maintenance module, the electrolyte reservoir tank, and a supply of gaseous nitrogen. The function of these components will be described below in detail.

In order to shorten the time needed to conduct a test, either a smaller sample length or a higher constant test current could be employed. However, lowering the current density improves repeatability as well as allowing the maximum sample surface per cell capacity. The SOT distributed by Continuus-Properzi is shipped with a default current density of 0.15 mAmp /cm^2, but this variable can easily be changed by the laboratory manager. Consequently, the customer can shorten the test time to be compatible with the time to produce one coil of finished hot rolled rod. In order to maintain reduction efficiency at a fairly consistent level, the SOT described herein allows nitrogen (or argon) to be bubbled through a frit submerged in the electrolyte. It can be made to automatically induce electrolyte renewal after a predetermined number of test samples have been run.

Additional automation features are present in this instrument. For example, loss of electrolyte in the cell is monitored by a sensor, and the loss is automatically replenished and controlled by specially developed software. Statistical process controls are employed in each controller display and can indicate sudden trend changes. Curve analysis is also performed automatically using first and second derivatives to obtain the inflection points that separate the time periods for both cuprous and cupric oxide reductions. Each of these oxide thicknesses and their total value are displayed on the controller. Currently, the SOT holds 100 past test results for the SPC function, and arrows are provided for the user to touch on the screen. However, if the user sends data through the Ethernet or RS232 they can retain all test results.
Several instruments described are already in the laboratory of the most important copper rod producers. *by Horace Pops*