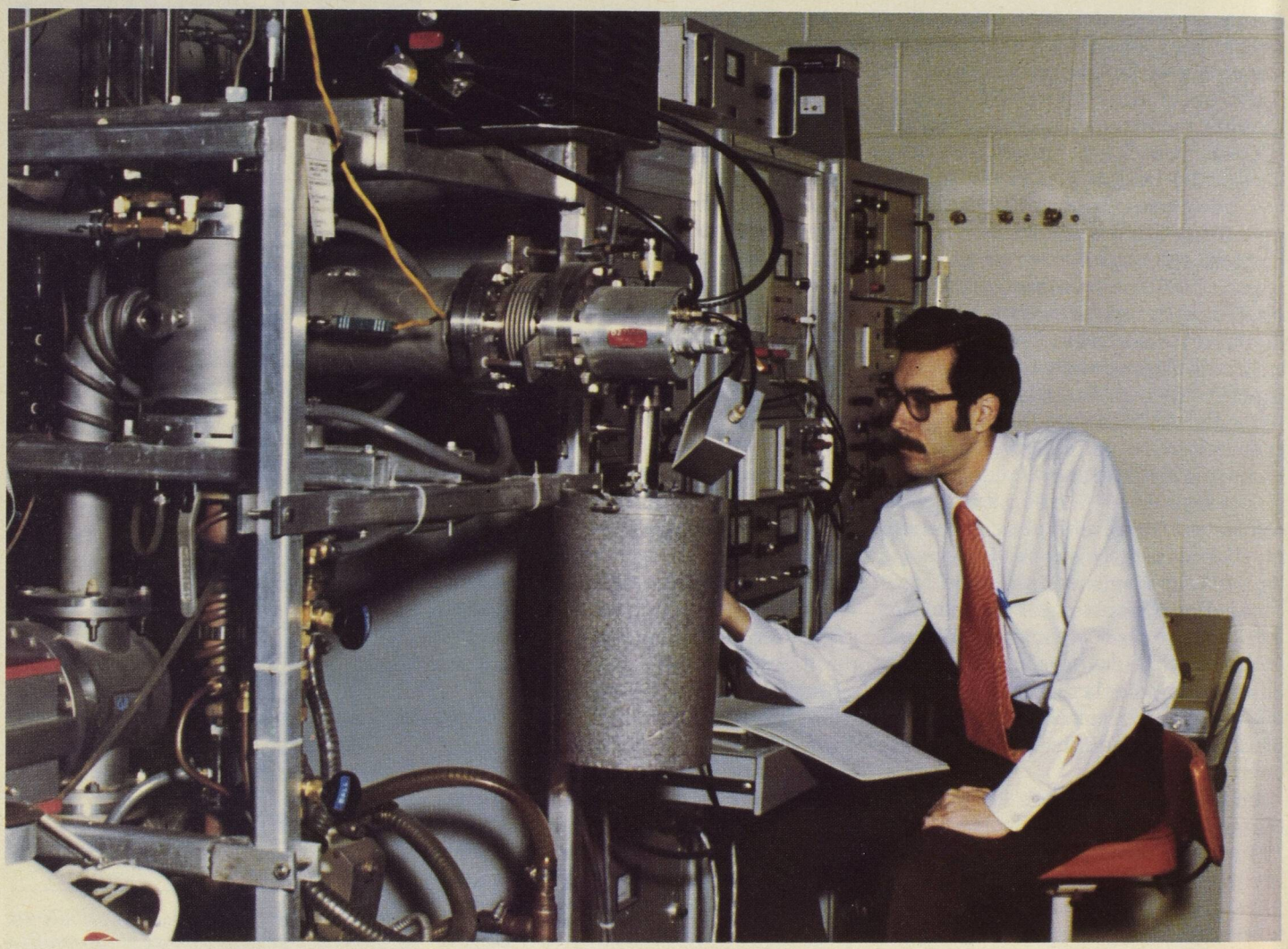
Precision pyrometrics

Savings in smelting



Dr. Bruce Conard records the result of one of the many tests performed during the project. *(Photo: INCO Research)*

Le Dr Conard note les résultats de l'un des nombreux essais effectués dans le cadre du projet. *(Photo: INCO Research)*

An NRC-supported study by metallurgists at INCO Metals Company, Sheridan Park, Ontario, could result in more efficient smelting furnaces for copper and nickel ores.

Transforming raw ores into marketable metal products is a complex, energy-consuming process. Smelter operators face a delicate task balancing energy-input against complex chemical changes inside their furnaces, especially as these changes both absorb and give off heat as elements combine or dissociate with increasing temperature. For the Canadian nickel and copper industries the problem has been a lack of basic information on the chemical changes of these Canadian ores, a drawback limiting the precision needed to husband energy. The result has been the use of energy-expensive techniques to produce finished metal. To provide the information needed on these metal processes, INCO Metals Company initiated an investigation of the reactions that take place in these ores at elevated temperatures.

"We spent some time scanning the literature for high temperature studies on these ores," says Dr. Bruce Conard of INCO's research facility, "and found sparse or inaccurate results. Canadian nickel and copper minerals, pentlandite and chalcopyrite, are nickel-iron and copper-iron sulfides linked by firm chemical bonds; they produce about a quarter million tonnes of nickel and three-quarters of a million tonnes of copper every year. That figure represents a small percentage of the ore material that must be processed to obtain the metals. Any small changes in energy efficiency in each step in the process can mean substantial savings in total future production costs."

Processing nickel and copper ores means carefully separating these minerals from waste rock without losing too much useful metal. From grinding the ore, through flotation techniques, to roasting, smelting and converting, each step in the process is designed to increase the weight per cent of metal in the material being treated. The last three operations occur at high temperatures (in the 1300°C range) and provide a metal sulfide free from rock and unwanted iron. Interaction of the various elements during these processes produce fluctuations in energy requirements, and a clear knowledge of these high temperature chemical events was the goal of Conard and his research team.