PRIMA
Advanced Materials Moving Forward

A **SUCCESS** STORY

ADDING VALUE TO MINE WASTE BY CREATING A NEW CATALYST FOR LOW-GHG HYDROGEN PRODUCTION

Rio Tinto Iron and Titanium (RTIT) has developed an upgraded slag (UGS) process to produce and market titanium slag with the highest TiO_2 content (94.5%). This process generates a significant quantity of UGS oxide (UGSO) that is sent directly to the mine waste repository (P-84, Sorel-Tracy) for final burial. To avoid this final operation, which is the least desirable in a sustainability context, **RTIT** and a research group led by **Professor Nicolas Abatzoglou** of the **Université de Sherbrooke** sought to add value to the UGSO chemical composition by transforming it into the ideal support for nickel-based catalysts in hydrocarbon reforming. The result is a new, patented and laboratory-tested Ni-UGSO catalyst. In terms of activity, yield and stability, it has demonstrated a catalytic performance equal or better than that of industrial catalysts at a production cost that is 5 to 10 times below that of competitors.

This project has led to the optimization of catalyst formulations and shapes to meet the conflicting requirements of **their industrial application**, namely good mechanical strength and improved catalytic activity while retaining a certain degree of porosity. Developments in hydrogen production focused on dry methane reforming, which uses two GHGs (CH4 and CO_2); this technology is currently taking its first steps on an industrial scale. The R&D work also revealed a catalyst that is just as effective and robust in both steam and mixed autothermal reforming (which uses the same two GHGs, plus a quantity of oxygen, thus enabling the reaction to take place without the need for external energy).

This project helped validate a technology that produces pellets from the selected catalyst formulation in compliance with the standards applicable to its industrial use. It also led to comparison tests with commercial catalysts. These tests were conducted by **Air Liquide** (the industry standard) and showed exceptional performance in three different reforming regimes. This characteristic remains **unmatched on the market.** Issues of stability remain, however, since it deactivates more quickly than its market competitors (50 to 100 times less specific surface area than commercial catalysts). Further projects are currently being developed to tackle this issue.

The average amount of **GHG emissions that would be reduced** or avoided over the first 10 years of marketing is estimated at 2.39 Mt CO_2 eq/year, at a cost of $20 to $50/t CO_2 eq. This project helped train one research professional, one doctoral student, and two undergraduate interns.

> ***The Université de Sherbrooke collaboration provided us with an opportunity to add value to mine waste while reducing the carbon footprint associated with one of our process consumables (hydrogen). The promising results that were obtained must still be confirmed by industrial catalyst manufacturers and users before we can move ahead with the product's development and marketing. We appreciate PRIMA's support and involvement. I have never seen any organization provide this kind of follow-up.***
>
> - **Guillaume Hudon**, RTIT Engineer

SECTORS
Energy, Environment

APPLICATIONS
CSM, low-carbon hydrogen, circular economy

TRL
Start 3-4, end 5

DURATION
36 months (2020-2023)

UDS Université de Sherbrooke

RioTinto