

**Name of the organization**

ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development)

Name of the infrastructure / laboratory

CR Casaccia / SIH2 cycle Laboratory (SIH2 Loop)

Address and country of the infrastructure / laboratory

ENEA C.R. Casaccia - Via Anguillarese 301 – 00123 Rome, Italy

Person responsible of the access / Contact person

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Main field of activity of the infrastructure / laboratory

► Hydrogen production

Short description of the infrastructure / laboratory

SI_Loop consists of a bench scale chemical loop for the Sulfur-Iodine thermochemical water-splitting cycle. In this laboratory plant, all wet elements are made of glass or fluoro-polymers. In the actual configuration the plant is designed to operate at pressures close to atmosphere; however, this facility is flexible to integration with improved components with minor modifications: for example, operations in the hydriodic acid decomposition section can be replaced with a single reactive distillation column, operating at high pressures, to improve cycle efficiency. A fully equipped chemical laboratory to investigate the unit operations involved in the process is also available. The demonstration plant is composed of three main sections, corresponding to the three main reactions of the chemical cycle: Bunsen section, HI decomposition section, and sulphuric acid decomposition section.

Main research area(s) of the infrastructure / laboratory

This plant allows H₂ production (from water) at a constant rate of ca. 10 NL/h, without the use of electrochemical cells, since the whole cycle is powered by heat at maximum 850°C. Hence, this facility allows development of the chemical plant in the perspective of its coupling with solar or next generation high-temperature nuclear plants. In this facility the external heat input is simulated by means of electrical heaters (Joule effect) whose overall power is the order of 10 kW. Particularly, this facility allows to: study each unit operation (separations, reactions, etc.) individually to identify best operative conditions; study the coupling between units; improve know-how on the S-I cycle management and train personnel; identify critical process steps to focus further research efforts to improve efficiency and feasibility; develop start-up and shut-down operations; collect performance data for the design of larger-scale (pilot, full-scale) equipment. The same facility can be also employed to study a new sulphur recovery process, based on the "open cycle" S-I process, where industrial sulphur wastes (solid sulphur, hydrogen sulphide, sulphur dioxide) are converted to hydrogen with or without concentrated sulphuric acid as by-product (this process involves only reactions 1 and 2).

Instruments and tools available for the above mentioned research

This laboratory has chemical cabinets equipped with gas monitoring systems and specific gas cabinet and dispensers to provide and manage harmful gases like hydrogen iodide and sulphur dioxide; besides, the laboratory is fully equipped with standard analytical instrumentation to analyze the process stream (e.g. ionic chromatography, hydrogen analysers, gas chromatography).

Access not available yet.

Information on the installation will be further updated.