materials ageing institute

EPRI ELECTRIC POWER RESEARCH INSTITUTE

CRIEPI Central Research Institute of Electric Power Industry

EDF

CORDEE

Chemistry, Corrosion and Deposits in the Secondary Circuit

To promote the life time of materials and optimize the operation and maintenance in the secondary circuit of nuclear power plant, it is essential to determine the optimum chemical conditioning in operation and during layup.

The research program of this project aims to provides results, mainly experimental ones, from the formation to the deposition of corrosion products: to reduce steam generators (SGs) fouling and clogging without enhancing further degradation and in support of the adequacy of secondary circuit chemical conditioning.

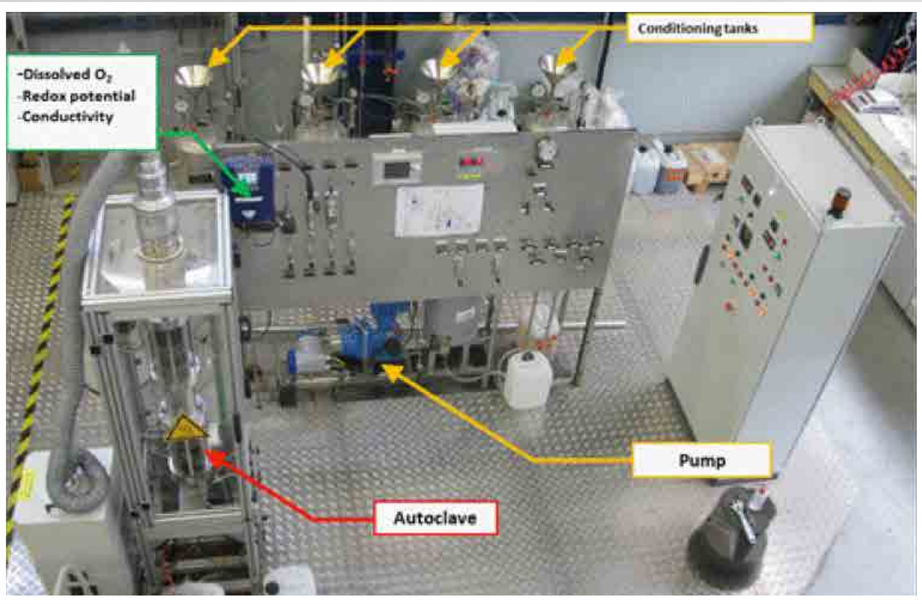

Fig. 1: ECCLIPS loop (Experimental Chemical Cleaning Loop to investigate Industrial ProcesseS).

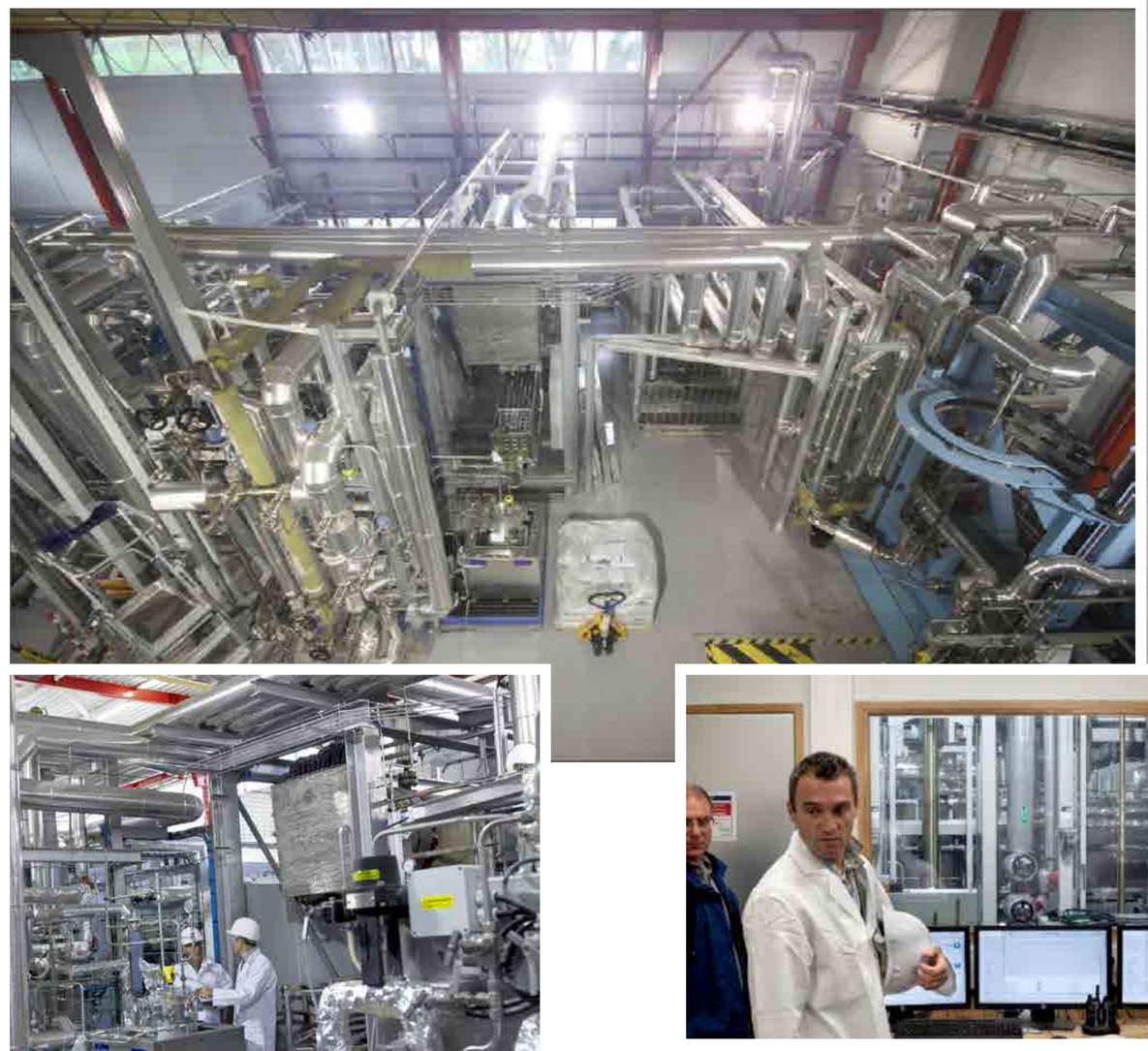

Fig. 2: ENERGIE set up and the control room.

Two approaches:

- **Prediction: mechanisms, kinetics versus parameters and simulation**

  A new test loop for SGs investigations: **ENERGIE** *(fig. 2)*, to determine in-situ tube fouling kinetic and deposit characterization under two phase flow conditions.

  A code, collaborative effort of EDF and EPRI, to simulate processes of the secondary circuit, to study the effect of water chemistry on material degradation rates and to model the deposition in the SGs: CIRCE™ tool.

Some recent results:

Understanding of hard sludge formation mechanisms (specific deposits on the tube plates of SGs which should enhance the risk of cracks at the base of the SGs tubes) *(fig. 3)*.

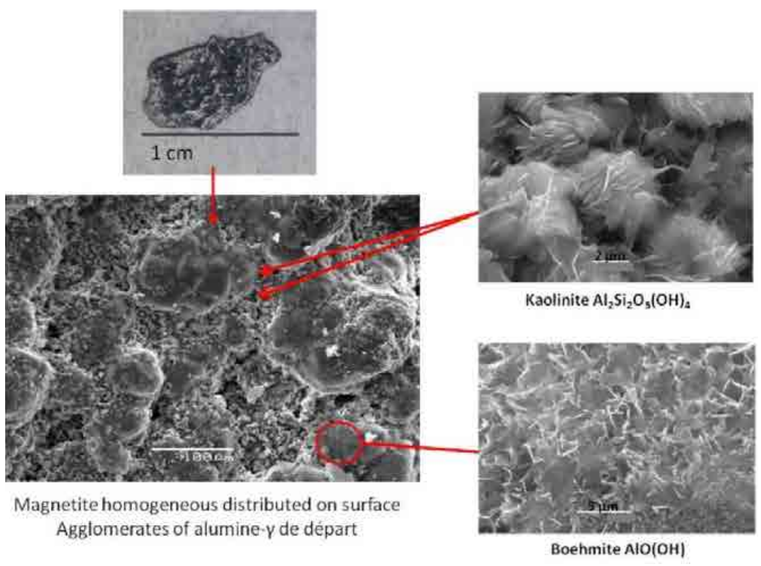

Fig. 3: Consolidated piece obtained in autoclave at 275°C.

- **Evaluation: innocuousness and efficiency**

  Several devices to study alternative conditioning products and current remedies of fouling and blockage in representative conditions of the secondary circuit:

  - ECCLIPS: chemical cleaning studies *(fig. 1)*
  - FORTRAND: feedwater system studies
  - CIROCO: flow accelerated corrosion studies - in-situ kinetic
  - Laboratory devices on stress corrosion cracking and on ion exchange resins

Evaluation of the impact of Film-forming amines (examine to prevent material degradations during layup) use on carbon steel surface, collaboration with CRIEIPI *(fig. 4)*.

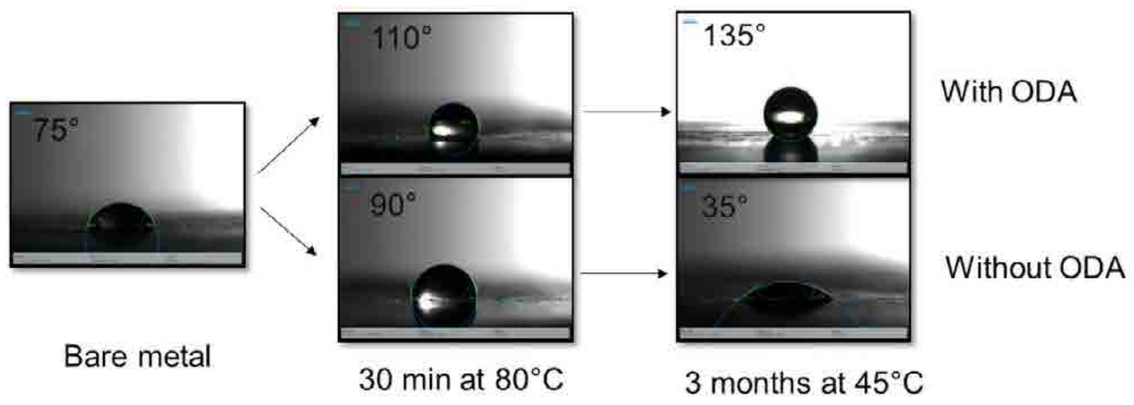

Fig. 4: SEM pictures of carbon steel surface hydrophobicity.