

Introduction

Platinum-group metals (PGMs, Pt, Pd, Rh) are the main core of an auto catalytic converters and play an important role in reducing the impact of the exhaust gases on the environment. There is an increasing demand for these materials but the natural resources are diminishing, therefore a solution could be the recycling of PGMs from the automotive catalysts.

In this study, we established an eco-friendly laboratory method for recovering of the PGMs by varying different experimental conditions such as: a mixture of acid (as leaching solution), temperature, pre-treatment. Furthermore, different precipitation techniques were employed in order to separate the individual ions from the leaching solution and to obtain high yield and purity for the recovered Pt, Pd.

Experimental and Results

Physical data characterization of the spent catalyst

Powder X-ray diffraction

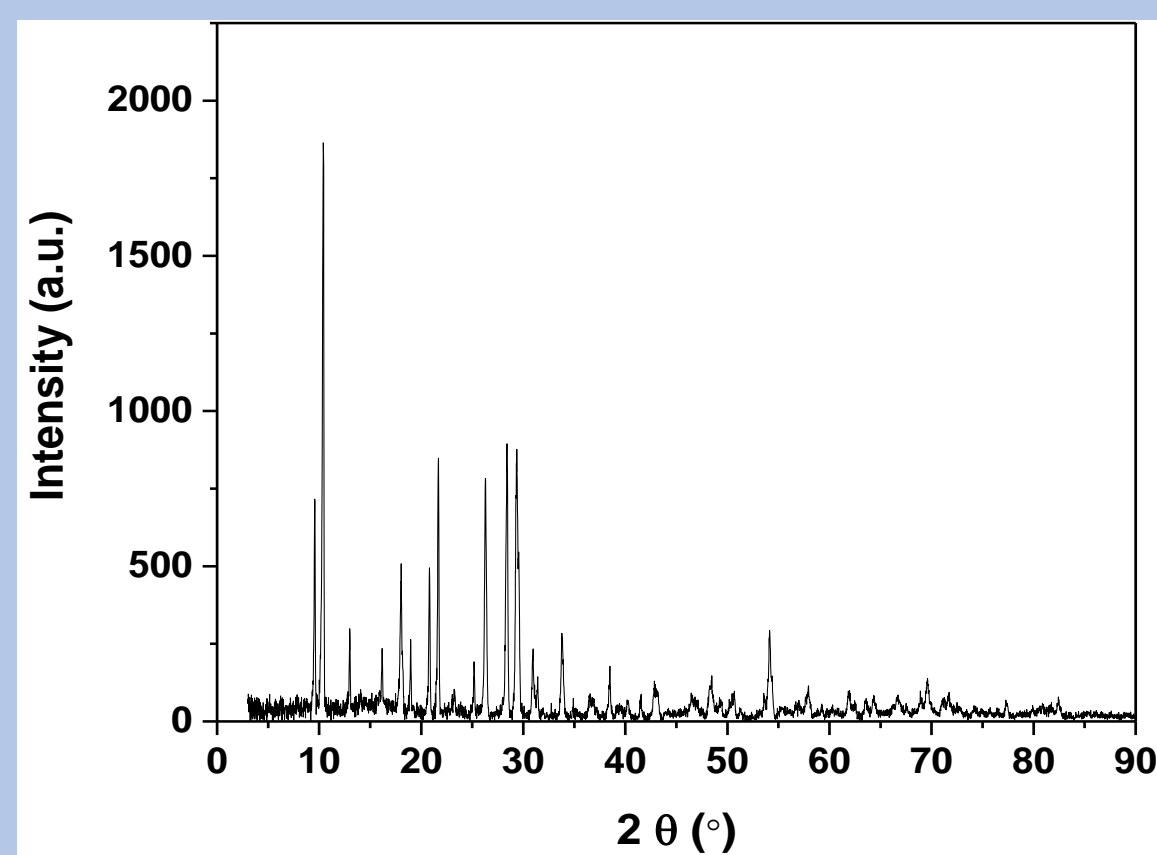


FIG 1. X-ray diffraction patterns for spent catalyst

Thermogravimetric analysis

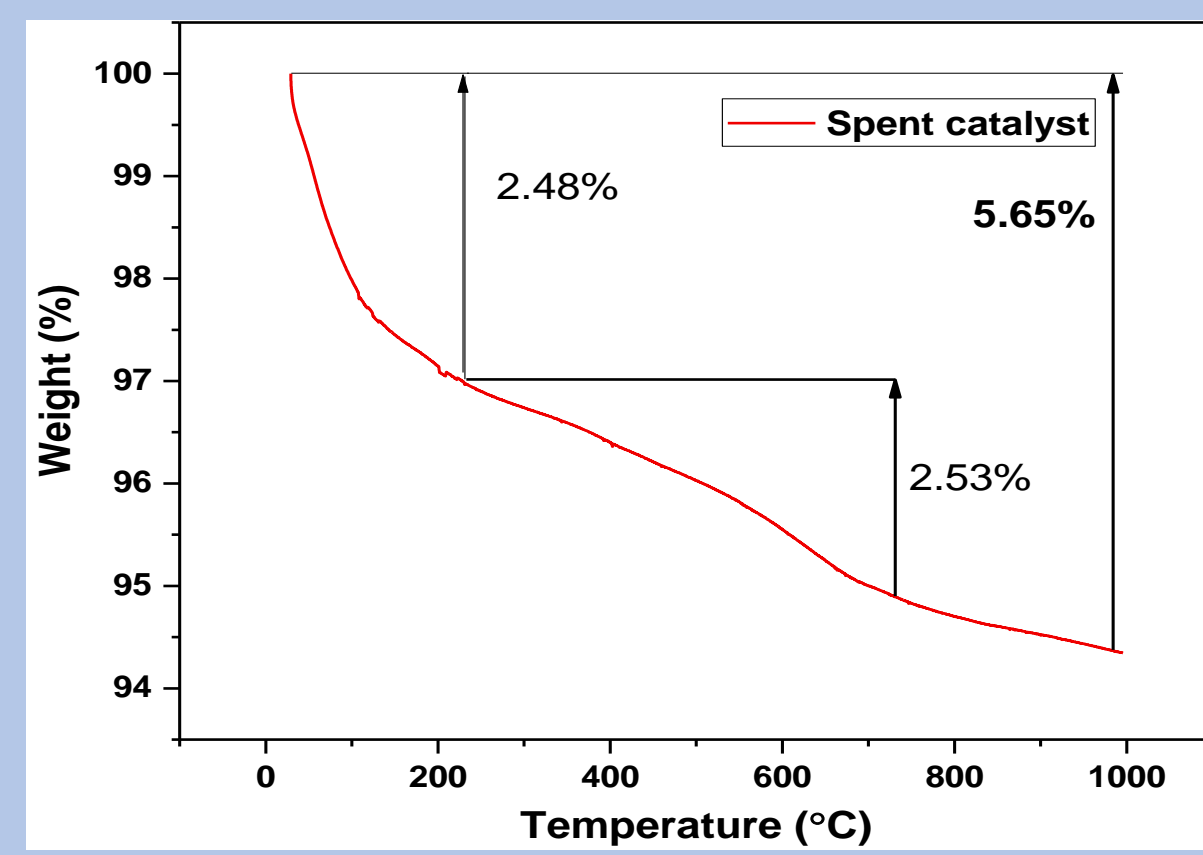


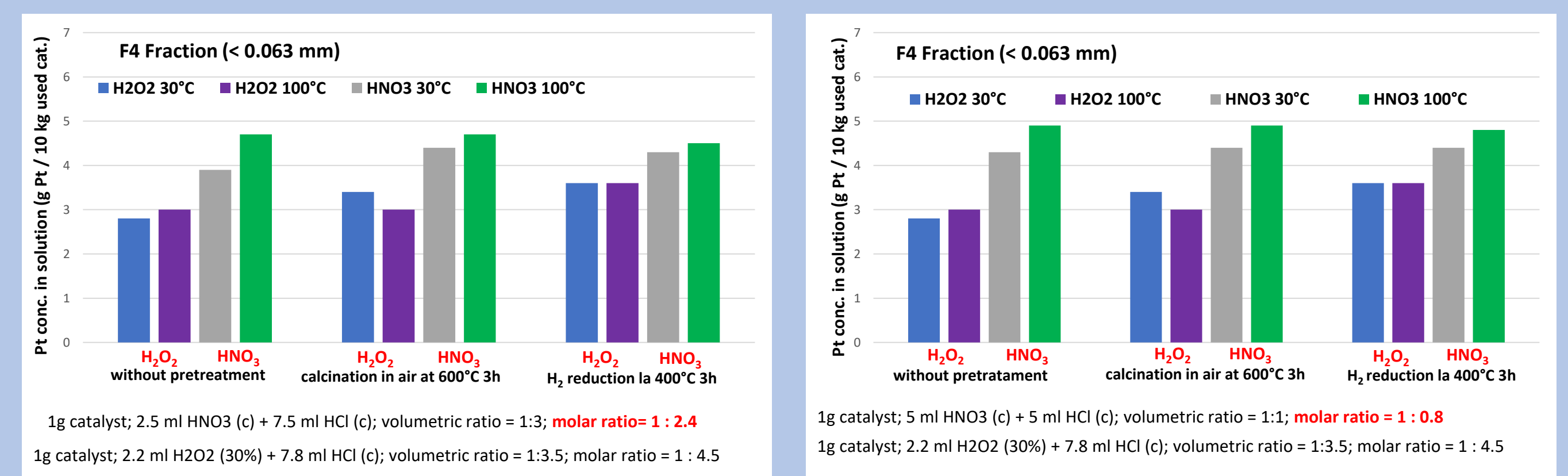
FIG 2. Thermogravimetric analysis of the spent catalyst

- Honeycomb ceramic structure mainly cordierite
- Low diffraction lines for Pt, Pd, Rh (low amount)
- Graphitic carbon on the surface

Experimental

Varying the acid mixture and the ratio

FIG 4. Acid mixture influence on the leaching solution for platinum recovery of the spent catalyst



No significant improvement is observed by replacing the HNO₃ with H₂O₂ and by modifying the ratio between the acids for

Pt recovery

The addition of H₂SO₄ to the acid mixture leads to a higher degree of

Experimental

Influence of different parameter on PGMs recovery

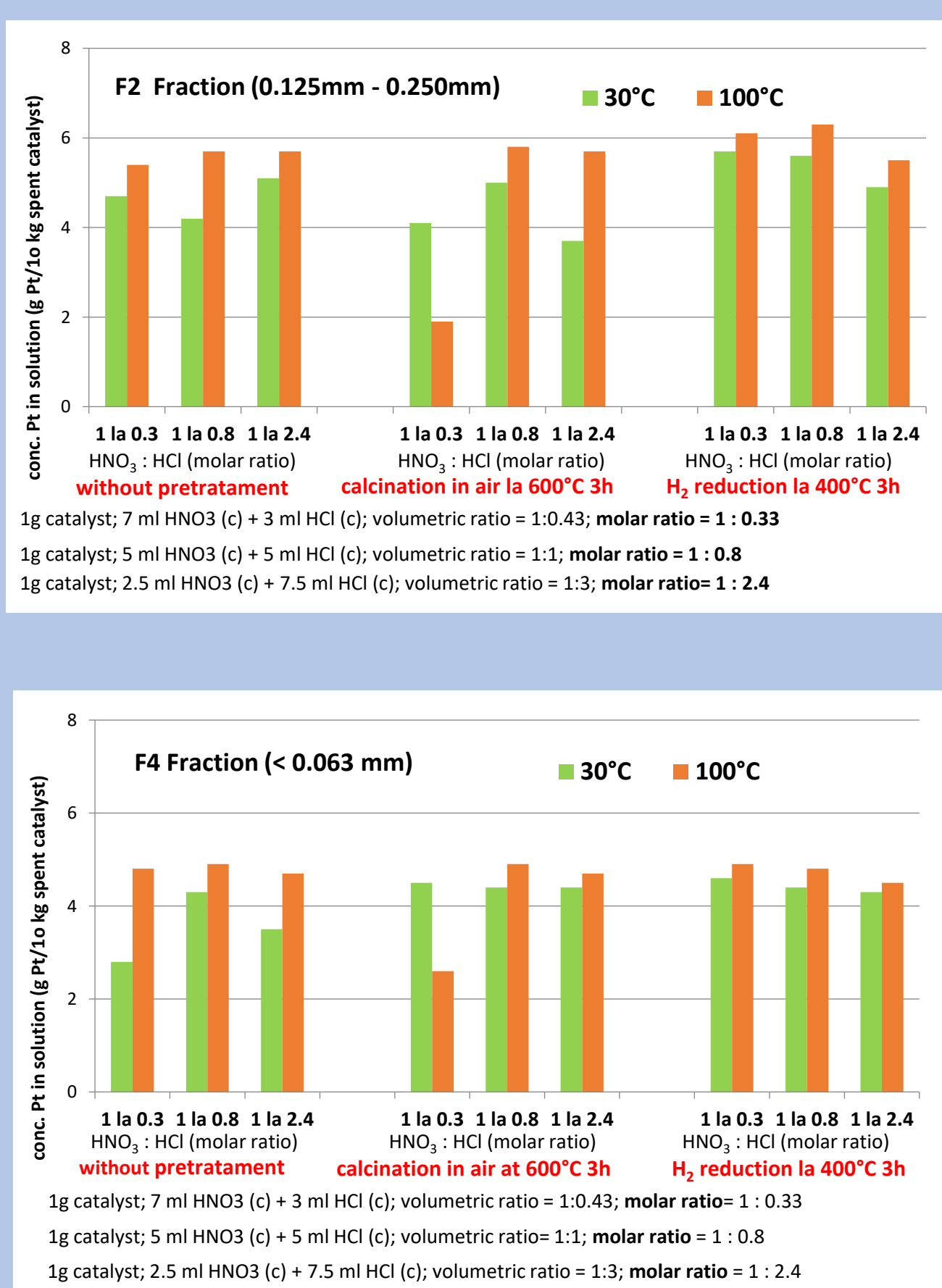


FIG 3. Temperature influence, molar ratio and pretreatment on the recovery rate on different fraction of the spent catalysts

Low difference between fraction for

Low influence of the oxidation treatment on

Pt recovery

Increasing the temperature leads to a better

HNO₃:HCl ratio no significant improvement on

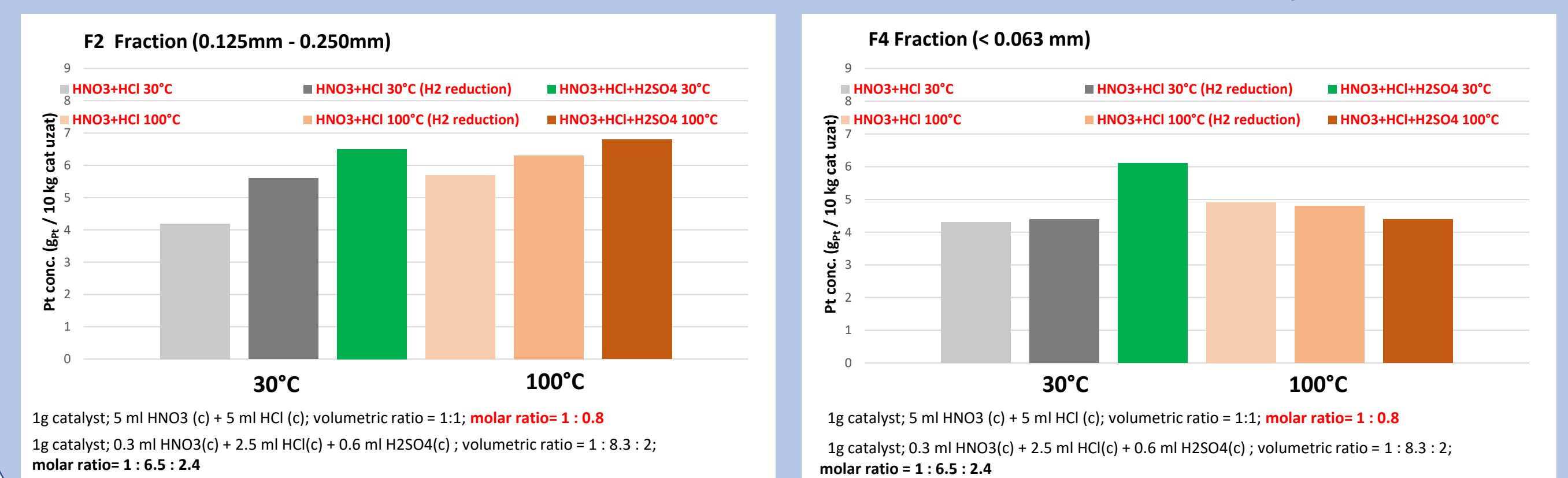


FIG 5. H₂SO₄ influence on the leaching solution for platinum recovery on the spent catalyst

Conclusions

- We have defined a method for pre-treatment of the spent catalyst
- We have established an optimum method for platinum recovery from the spent catalyst
- For a higher degree of platinum recovery, the optimum parameters are: a mixture of acid solution (HNO₃+HCl+H₂SO₄ = 1:6.5:2.4 (molar ratio)), solid : liquid ratio = 1:3.5 ml and leaching time = 24 h

Acknowledgment