Report
Study of nickel ore

Task

Evaluating the possibility of online, real-time analysis of Ni, Cu and Fe containing ore.
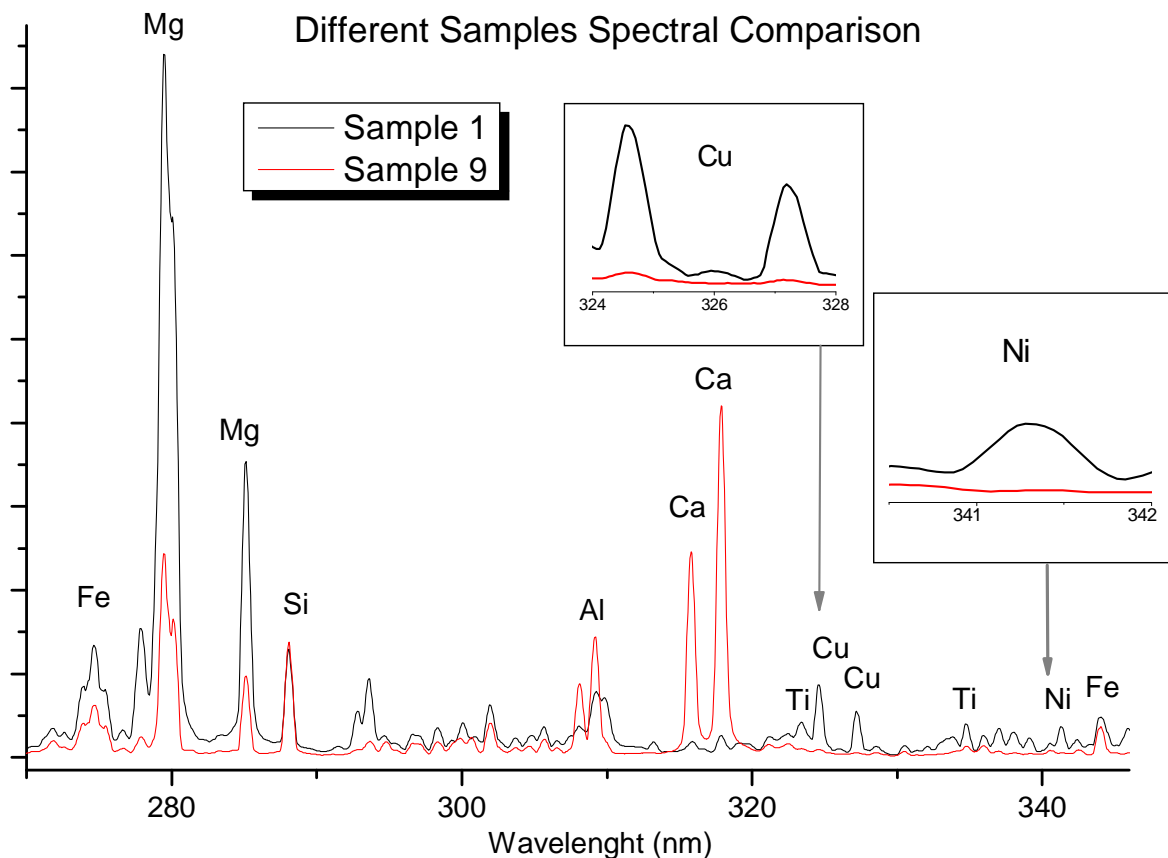
Incoming samples

The incoming samples are of 2 types: 10 powder and 7 samples of -5mm pebble.

Technical requirements

Measuring Fe, Cu and Ni Concentration.

Spectral Comparison.

Here, example of spectral difference between samples 1 and 9 is demonstrated:

In additions to the required Fe, Cu and Ni other elements such as Mg, Si, Al, Ti and Ca can be easily detected. Spectral difference can be clearly seen: sample 1 (black) have much higher Fe content than sample 9 (red). Also it's Cu and Ni levels are much higher (The squares inside the chart field are enlargement of Cu and Ni regions).

On the contrary, sample 9 have much higher Al and Ca content while Si and Mg content is difficult to quantify without calibration laboratory results.

Quantitative analytical algorithm

According to the received laboratory data, analytical algorithm was developed and demonstrated as correlation curves for powder and -5mm batches for all the analyzed elements:
(Vertical lines show standard deviation inside each measurement, indicating reproducibility. In Fe and Ni charts, sample 9 was excluded because of its mismatch with other samples)
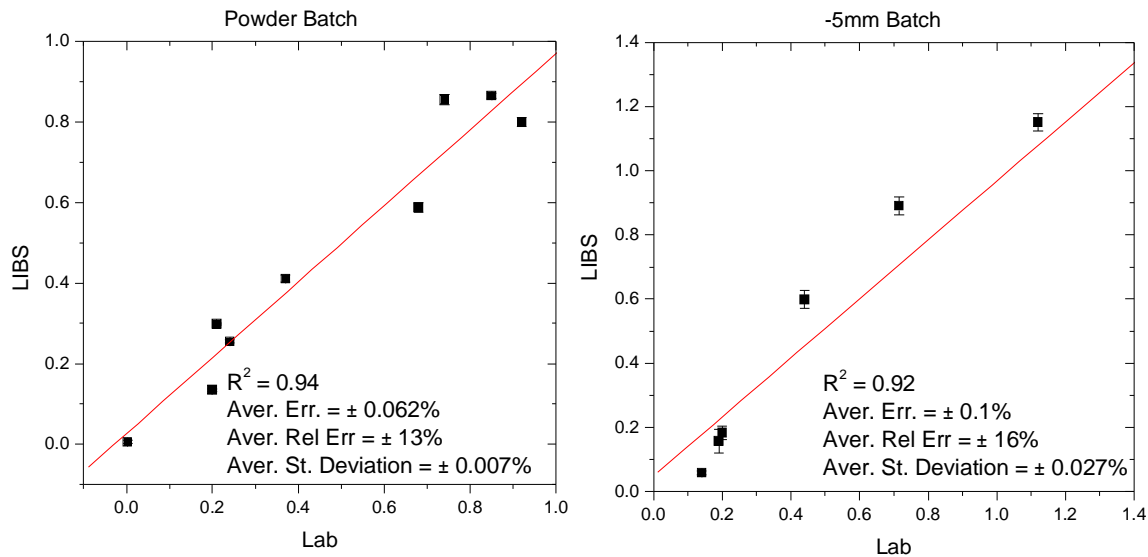
Lab vs. LIBS Comparison for Fe
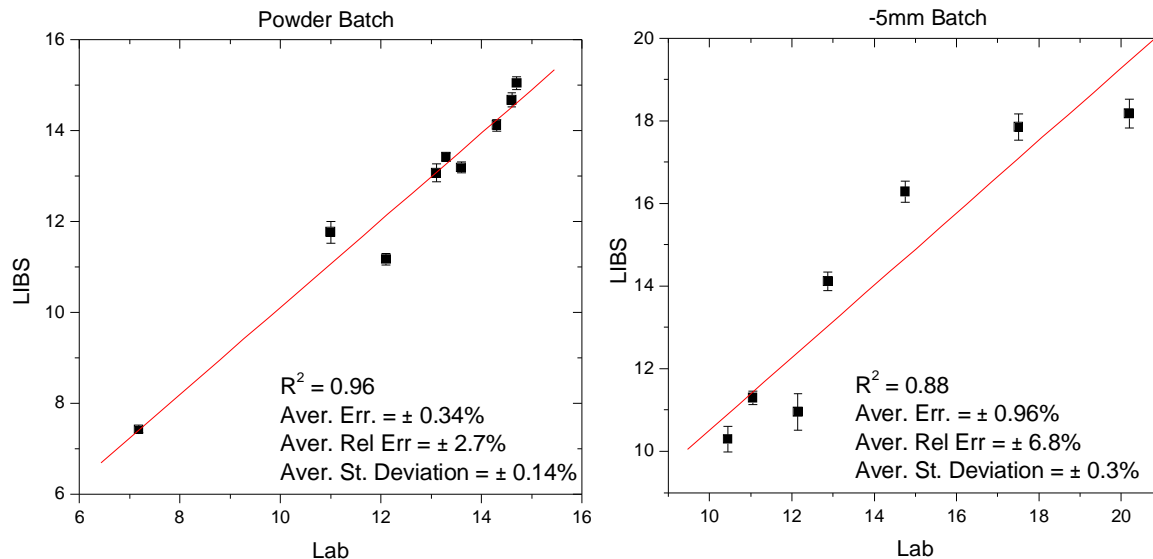
Lab vs. LIBS Comparison for Cu
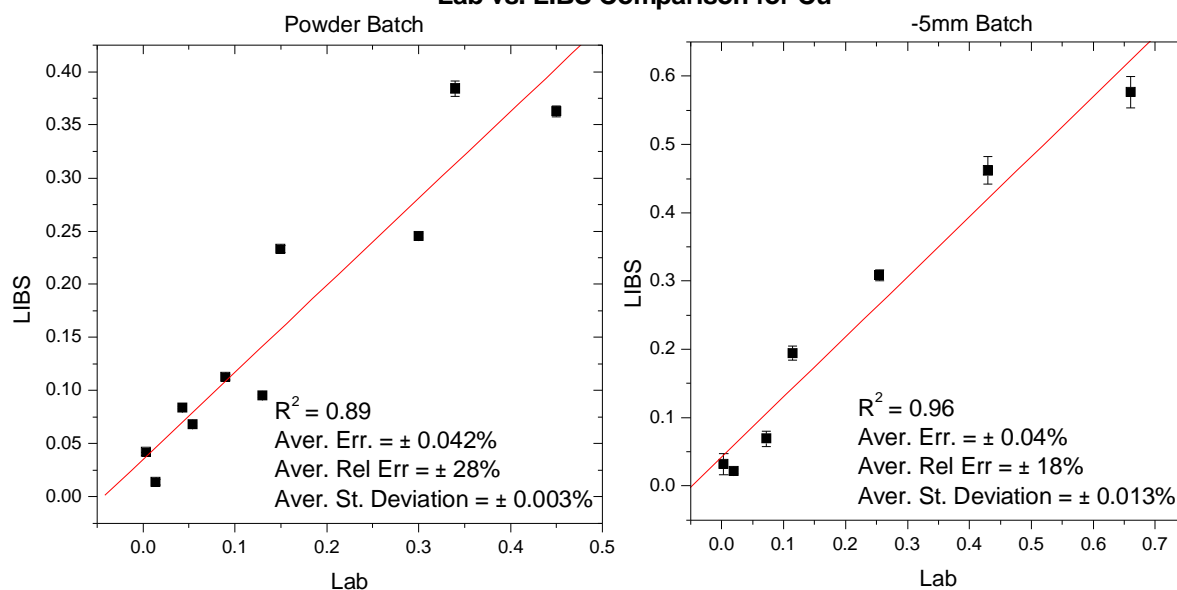
Lab vs. LIBS Comparison for Ni

The results

All The laboratory analyzed elements have shown good correlation and reproducibility, low absolute and relative errors.

It's seen that -5mm batch reproducibility is lower than powder batch reproducibility because obviously, powder batch is more representing.

Conclusions

On-line, real-time analysis of nickel ore is definitely possible.

High accuracy and reproducibility can be achieved.

Except of the analyzed Cu, Fe and Ni elements, additional materials like Mg, Ca, Si, Al and Ti able to be analyzed.