Emission signal enhancement in double-pulsed laser induced plasma on collinear geometry

Duixiong Sun, Maogen Su, Chenzhong Dong

Laser induced breakdown spectroscopy (LIBS) has a great potential in a broad field of analytical and specialized application, compared with other spectrometric methods [1], the sensitivity of LIBS is poor, and matrix effect sometimes restrict LIBS application for quantitative analysis, therefore, strengthening of the LIBS signal in analytical samples is thus the natural objective of the present detection. In order to advance signal detection capability and to increase the sensitivity of LIBS, double-pulsed (DP) LIBS has been investigated in order to address these problems. Collinear DP LIBS is better in terms of industrial applications due to the simple optical alignment; therefore, investigation to emission enhancement mechanisms in this geometry configuration can give the optimal parameters for improving the sensitivity of DP LIBS.

Time- and spatial-resolved LIBS technique was used for investigating the plasma characteristics in aluminum-based alloys. Q-switched Nd:YAG lasers at 1064 nm wavelength have been employed to generate laser-induced plasma on aluminum-based alloys by SP and DP LIBS schemes. Time and spatial evolution of the plasma temperature and electronic density were investigated in these two schemes. The line intensity enhancements were investigated; a relation between increases in intensity and excitation energy level was established. Moreover, In our experimental condition, we found that the second plasma production was important in DP experiment on collinear geometry, meanwhile, we found that two sequential laser pulse with a certain delay time made the plasma to become more inhomogeneity and optical thick. To assess DP LIBS performance in analysis, the calibration curves for some elements present in alloy were established.

References

[1] P. Fichet, M. Tabarant, B. Salle et. al., Anal. Bioanal. Chem. 2006,385: 338