Supporting Information

High-accuracy prediction of carbon content in semi-coke by laser-induced breakdown spectroscopy

Xiangjun Xu, Angze Li, Xianshuang Wang, Chunjie Ding, Suling Qiu, Yage He, Tianqi Lu, Feng He, Bingsuo Zou and Ruibin Liu*
Beijing Key Lab of Nanophotonics and Ultrafine Optoelectronic Systems, School of Physics, Beijing Institute of Technology, Beijing 100081, China.
E-mail: liusir@bit.edu.cn;

1. The concentration ratio and type of binder are critical for sample pretreatment. Here, the optimal concentration of binder at around 50% are utilized, then the semi-coke powder is mixed with variety binders for pressing test. The pressing test results of different kinds of binders are listed in Table 1. Only when the weight of semi-coke is 0.3 g, KF, KBr, and KCl are each 0.1 g, the semi-coke powder are easily pressed into a slice, other ratios of binders are hard to be pressed as coal slice. Therefore, the mixture weight is designed to be 0.6 g for one sample and the binder of KF, KCl, and KBr is designed to be 0.1g respectively.

Table 1. The pressing test results of different kinds of binders.

Number of experiments	1	2	3	4	5	6	7
semi-coke (g)	0.3	0.3	0.3	0.3	0.3	0.3	0.3
KF (g)	0.3	0	0	0.15	0	0.15	0.1
KCl (g)	0	0.3	0	0.15	0.15	0	0.1
KBr (g)	0	0	0.3	0	0.15	0.15	0.1
Whether it is pressed to slice.	No	No	No	No	No	No	Yes

2. Photographic images of sample, (a) the pressed coal slice with diameter 30mm with the binder assistance and (b) the double-sided tapes after painting the sample powder evenly on the surface.

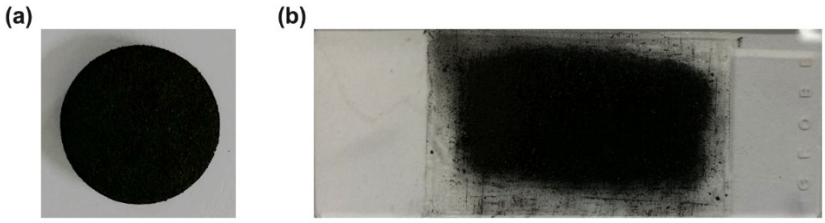

Fig. 1 (a) One typical coal slice of semi-coke sample with binder added. (b)The double-sided tape painted evenly with semi-coke powder.

3. As shown in Fig. 2, the temperature is fitted using four emission lines of Ca, and the correlation coefficient R^2=0.989. For the 200 measurements, the correlation coefficient of the fitting is greater than 0.98, indicating the accuracy of the method is enough high.

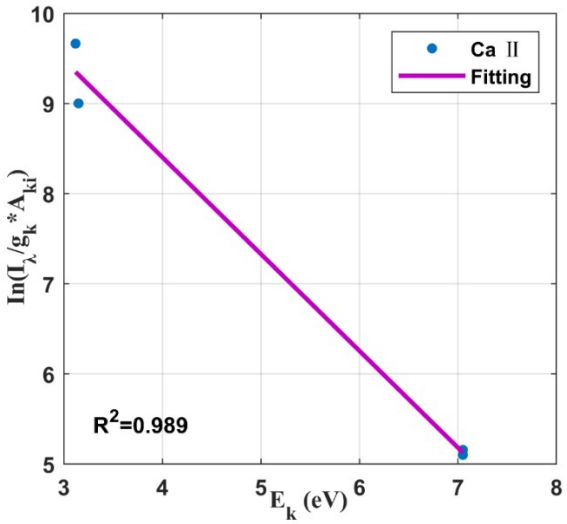

Fig. 2 Boltzmann plot method to fit plasma temperature

4. The spectral stability of the semi-coke sample from these two pretreatment methods is quite different. As shown in Fig. 3, the average RSD of the characteristic peaks are 12.1% and 16.2%, respectively, indicating that the easy way with painting sample on tape exist measurement and prediction uncertainties.

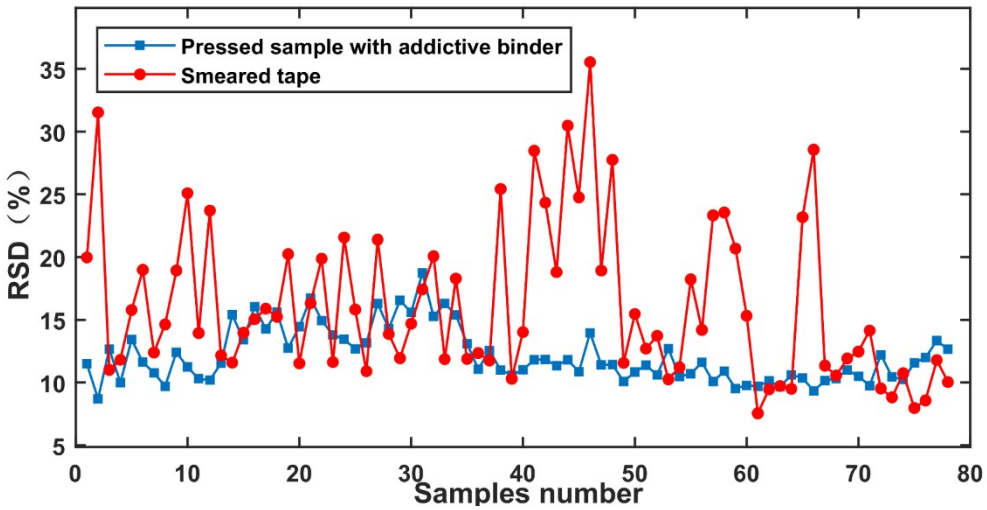

Fig. 3 RSD from C (I) 193.09 nm under different samples under various treatments

