

FORMATION OF ACTIVE INTERPHASE ON THE IRON PARTICLES IN C/PVDF MEDIA

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The use of catalyst support materials is essential for nanostructured catalytic systems for many energy-transformed devices. Ideal catalyst carrier should possess such properties: high conductivity, high surface area, low cost, electrochemical inertness, and stability. Carbon-based materials have been used as catalyst supports for a long time due to their unique properties such as, physical stability, excellent conductivity, and high surface area. That is why, the study of the formation of new interphases on the iron surface in the composite Fe/C/PVDF films and their impact on thermoelectric properties of composites are actual for the development of a new generation of energy storage. The aim of this work was, the study differences in the quantity of the elements and their ratio on the surface of iron particles and in the volume of the carbon phase.

Experiment

Activate Carbon brand BAU-A and the Iron brand powder FGD 3.200.28-30 with a bulk density of 2.7 ± 0.2 g/cm³ and a particle size of up to 300 μm was chosen as the main components of the composition (Table 1). As a binder for composite components was the 5% solution of the PVDF in the acetone. The mass ratio of the components in the interphases were calculated relatively absolute atomic masses of the elements.

Table 1 Mass fraction of impurities in the iron, wt. %

C	Si	Mn	S	P	O
0,05	0,08	0,20	0,02	0,02	0,5

The micromorphological studies of composite samples and quantitative microanalysis of the surface were performed on a scanning electron microscope Tescan Mira 3 LMU, and on energy dispersed spectrometer Oxford Instruments X-Max 80 mm² SDD (Table 2).

The difference in the oxygen content on the surface of iron particles and in the volume of graphite indicates the higher impact of the PVDF in the case of iron particles. It may be connected with the ability of Fe coated by Fe₃O₄ in the presence of graphite to induce the reduction of Fe³⁺ to Fe²⁺ with the generation of free high reactive oxygen [1]. High reactive oxygen is able to form -O-O- and C=O groups on PVDF mainly due to exchanging F in C-F [2]. So, on the surface of iron particles forms a new interface (with size 30 ÷ 80 nm) saturated by active oxygen compounds with high mobility. Confirmation of high mobility of oxygen species is the analysis of graphite in the volume, where at a distance of more than 30 μm the presence of oxygen was found, but in smaller quantities. Also, in this region was detected Fe. If the presence of Fe₂O₃ takes place, the probability of the formation Fe₃C increases in the graphite space. Thus, the simultaneous presence of proactive compounds of oxygen and iron carbide should significantly affect the formation of gradient phenomena and change the thermoelectric properties of the whole system.

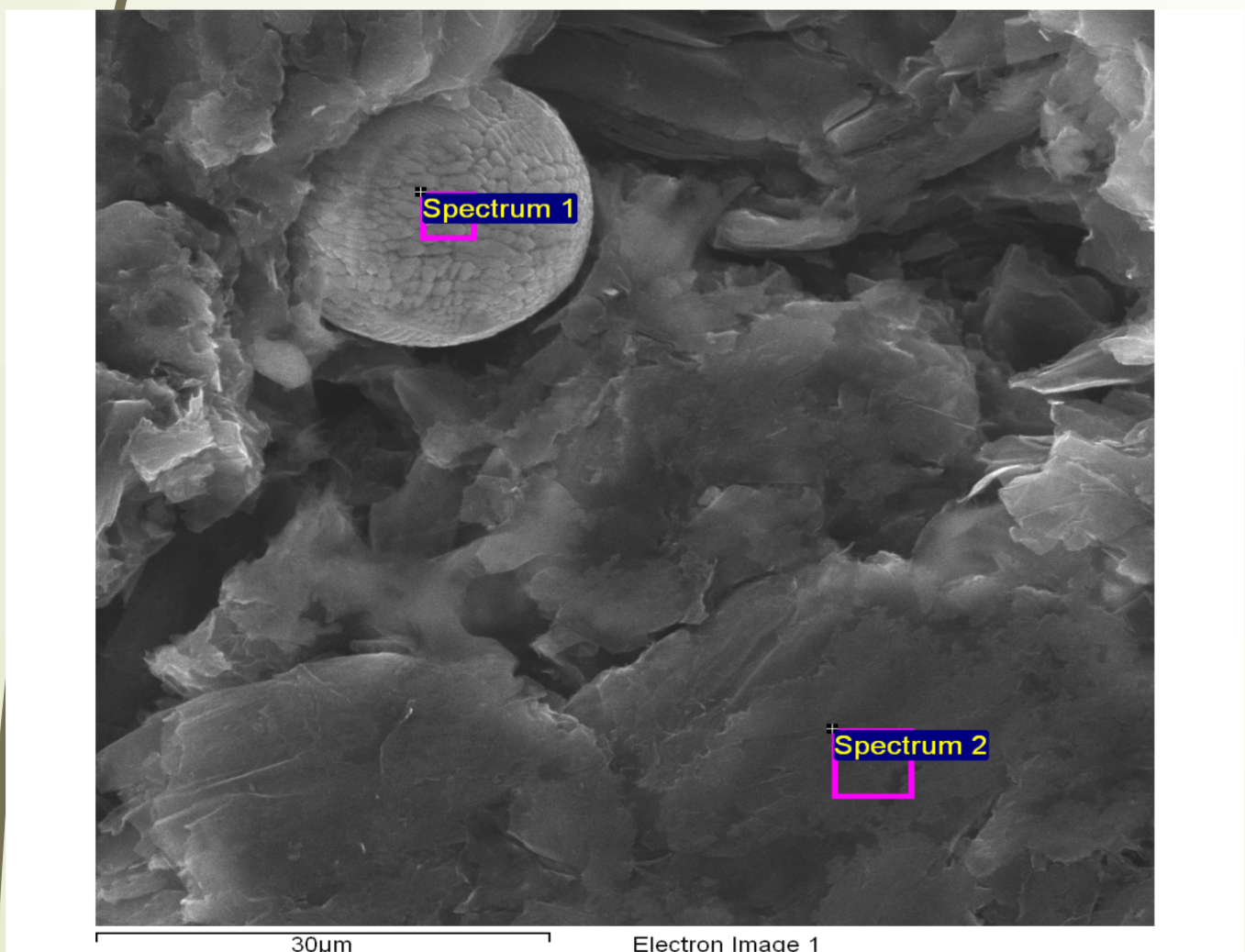


Fig. 1. Areas of spot scanning of the component composition

Table 2. The composition of the surface of the composite film, wt. %

Zones of the film	C	O	Fe	F	Ratio (formula)
Zone 1	23.21±2.1	48.83±0.3	26.23±0.5	0.77±0.5	FeC ₄ O ₆
Zone 2	96.44±2.1	2.79±0.3	26.23±0.5	0.77±0.5	Fe ₃ O C ₄₈

Conclusions The simultaneous presence of proactive compounds of oxygen and iron carbide should significantly affect the formation of gradient phenomena and change the thermoelectric properties of the whole system.

References

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