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Research Article

THE EFFECT OF ACID CONCENTRATION ON THE DISTRIBUTION OF THE ELECTROLYTE BY SEPARATOR HEIGHT

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ABSTRACT

Various factors affect the performance of storage batteries and can reduce their performance. In practice, it is very difficult to realize the full use of active materials involved in the current generation process. About half of the active mass level does not participate in the reaction with the electrolyte, because they serve as the basis for making the electrode frame and ensure the mechanical strength of the materials. Therefore, the coefficient of real use of active materials of positive electrodes is 45-55%, and that of negative electrodes is 50-65%. In addition, a 35-38% solution of sulfuric acid is also used as an electrolyte. Therefore, the actual consumption of materials is higher than the theoretical consumption, and the actual energy volume is somewhat lower. The leakage of the electrolyte from the separator largely depends on its concentration. First, if the density of the electrolyte decreases, its weight decreases, which reduces its flow, but the decrease in density leads to a decrease in viscosity, which increases its fluidity. Therefore, it is desirable to determine the relationship between the concentration of the electrolyte, its distribution over the height of the separator and its fluidity during the experiment. This is a very important factor, as the electrolyte concentration changes after a certain period of time during battery operation, and the optimal concentration of the acid used as an electrolyte plays a major role in ensuring performance. In these studies, the effect of the concentration of the electrolyte used as a working electrolyte on the working efficiency of the batteries as a result of the increase in the pores of the separator and the change in fluidity at different compression levels was studied.

KEYWORDS

In these studies, the effect of the concentration, a decrease in viscosity, which increases its fluidity.

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INTRODUCTION

During the research, experiments were conducted to study the effect of acid concentration and optimal conditions for maintaining the electrolyte absorbed in the separator at a certain height. In this case, the extent to which the electrolyte fluidity changes at different compression levels of the separator and at different electrolyte densities was practically checked (Figures 1.1-1.3). Experiments were carried out in a 4-layer separator with compression levels of 0, 40 and 70%, respectively, and when 28% and 37% sulfuric acid were used as the electrolyte (28% electrolyte is the smallest concentration at which the battery will work, 37% electrolyte is the electrolyte concentration at which the new battery is poured) . As can be seen from the results of the experiment, in Figure 1.1, when the compression ratio is 0%, the acid concentration does not affect the diffusion of the electrolyte along the height of the separator. In our second experiment, in a 2-layer separator, we found that the concentration of the acid had little effect on the diffusion of the electrolyte along the height of the separator in our sample with a compression ratio of 40% (Figure 1.2). In our third sample with 70% compression, we saw that the acid concentration had a significant effect on the diffusion of the electrolyte along the height of the separator (Figure 1.3).

At low compressibility, the pore sizes in the separator structure are relatively large, and the concentration of the electrolyte at the top is not significantly affected by the concentration.

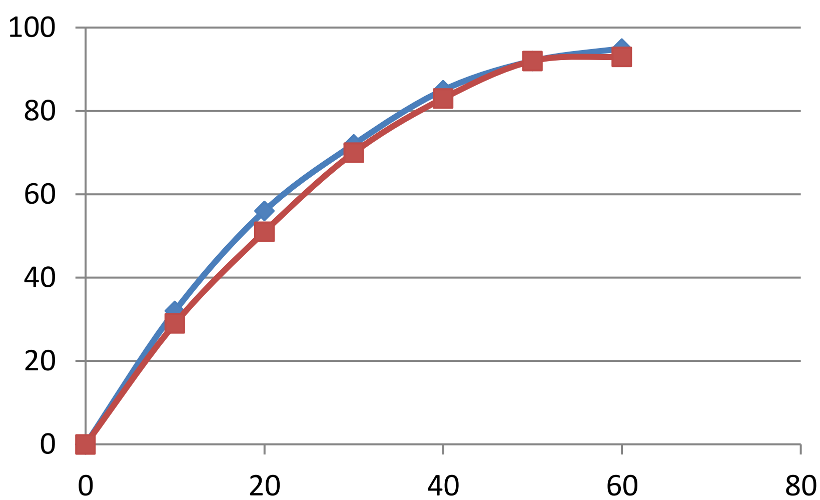

Figure 1.1. The effect of acid concentration on the distribution of electrolyte along the height of the separator (R=0 kPa) – 28 % (1), 37 % (2)

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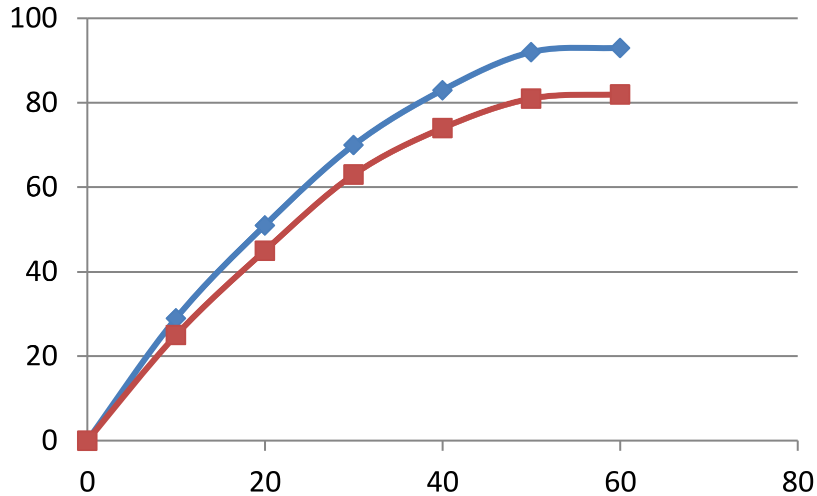

Figure 1.2. Electrolyte spread over the height of the separator Compression level 50%; acid concentration – 28% (1), 37% (2).

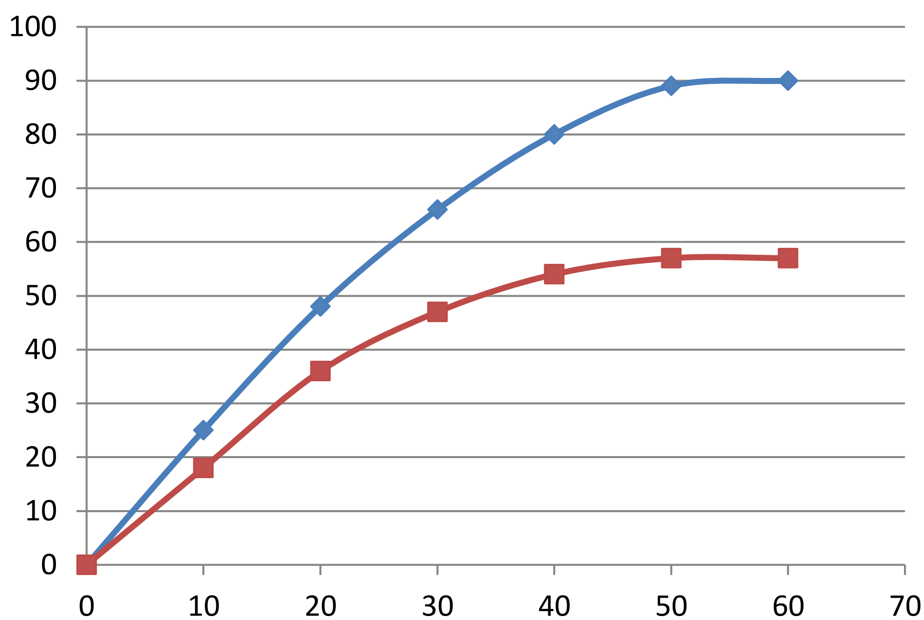

Figure 1.3. Electrolyte spread over the height of the separator Compression level 70%; acid concentration – 28% (1), 37% (2).

Electrolyte flows mainly through the open pores in the vertical column, and remains in the closed or circular pores. This condition is observed even when compression is applied to a lesser degree, but when

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the degree of compression increases above a certain value, this value begins to vary significantly between electrolytes of different concentrations.

When the separators are compressed to 70%, the sizes of the relatively large pores in it are reduced, the number of dead-end pores increases, and the role of capillary forces in maintaining the electrolyte at a height begins to increase. Therefore, in our last sample, in electrolytes of different concentrations, the difference in their downward flow increases, in which, together with capillary forces, the density and, in turn, viscosity of the electrolytes begin to play a role.

From the results obtained during the conducted research, it became clear that when the degree of compression is 0-40%, when the concentration of acid is 28-37%, the efficiency of the distribution of the electrolyte along the height of the separator is almost not affected. Depending on its value at compression ratio 50-70%, the leakage of electrolytes of different concentrations in the separator is different, while the leakage decreases as the concentration increases.

CONCLUSION

The average values obtained from experiments to determine the dependence of the thickness of the separator on the degree of impregnation with electrolyte at different pressures show that when the separator was impregnated with an electrolyte consisting of 28-30% sulfuric acid up to 70%, the expansion of the pressure in the range of 15-25 kPa had the lowest value.

REFERENCES

1. GOST 1051-2003 Qo'rg'oshin kislotali akkumulyatorlariga qoyilgan texnik talablar.
2. GOST 9.312-98.Korroziyadan himoyalash va eskirishning yagona tizimi. himoya qoplamalari. Olovbardoshlikni aniqlash usullar.
3. Виноградов С.С. «Промывные операции в гальваническом производстве» /Под редакцией проф. В.Н. Кудрявцева. – М.: Глобус, 2007. – 157с.
4. M. Safari, M. Morcrette, A. Teyssot, and C. Delacourt, "Multimodal physics- based aging model for life prediction of li-ion batteries," Journal of The Electrochemical Society, vol. 156, № 3, 2009, P 145–153.
5. I. Laresgoiti, S. K¨abitz, M. Ecker, and D. U. Sauer, "Modeling mechanical degradation in lithium ion batteries during cycling: Solid electrolyte interphase fracture," Journal of Power Sources, vol. № 30, 2015, P 112–122.
6. Bloom, I.; Cole, B.W.; Sohn, J.J.; Jones, S.A.; Polzin, E.G.; Battaglia, V.S.; Henriksen, G.L.;Motloch, C.; Richardson, R.; Unkelhaeuser, T.; et al. An accelerated calendar and cycle life study of Li-ion cells. J. Power Sources 2001, №101, P 238–247.
7. Feng, X.; Li, J.; Ouyang, M.; Lu, L.; Li, J.; He, X. Using probability density function to evaluate the state of health of lithium-ion batteries. J. Power Sources 2013, № 232, P 209–218.
8. Deshpande, R.; Verbrugge, M.; Cheng, Y.; Wang, J.; Liu, P. Battery cycle life prediction withcoupled chemical degradation and fatigue mechanics. J. Electrochem. Soc. 2012, №159, P 1730–1738.
9. R. Hausbrand, G. Cherkashinin, H. Ehrenberg, M. Gröting, K. Albe, Fundamental degradation mechanisms of layered oxide Li-ion battery cathode materials: Methodology, insights and novel approaches, Materials Science and Engineering. № 192, 2015, P 3–25.