ITE-GTP Activator Technology for Chinese Lead-acid Batteries

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Abstract
ITE activators a mixture of organic polymers and inorganic salt were used for 60Ah dry charge lead-acid batteries and the battery performance was compared to the best Japanese lead-acid batteries. With the ITE organic polymer activator, the Chinese battery performance was found to be much better than Japanese batteries for our 150 ampere test and 12 ampere test.

Keywords
organic polymer activator, negative electrode, discharge test

1. INTRODUCTION
Many organic compounds have been examined in order to find a good activator for deteriorated lead-acid batteries since 1996 [Kozawa et al., 1997]. We found that water soluble organic polymers with or without fine carbons are very effective for regeneration of the deteriorated lead-acid batteries [Sato et al., 1997]. In this paper we tested an organic polymer mixture (no fine carbon power) for new Chinese batteries (GTP brand) and compared the Japanese best batteries for the performance and the cycle life. The conclusion is that the Chinese GTP brand batteries containing our ITE activator are much better in the performance for 12 ampere and 150 ampere discharges compared to the top level Japanese batteries in which no organic polymer was added.

2. EXPERIMENTAL
2.1 Chinese batteries used
GTP brand of 50B24 (60Ah for 20 hr rate and 36Ah for 5 hr) was used. The battery contained about 0.5g of organic polymer activator per cell. The size was 236 x 128 x 204mm. The weight was 9.7kg. The battery was dry charge type. Nitrogen gas was filled in the batteries before sealing in order to prevent air oxidation of the negative electrode. Before use the battery was filled with sulphuric acid electrolyte (s.g. 1.280).

2.2 Japanese batteries used
Japanese batteries used for comparison is P-brand, which was top level high quality lead-acid battery (3 year or 60,000km guarantee). The battery was 50B24L.

2.3 Discharge tests
2.3.1 The 12 ampere test
The test was done discharging the battery continuously at 12 ampere to the end voltage of 10.5 volt. Then the battery was charged at 6.0 ampere to 15 volts.

2.3.2 150 ampere test
The battery was discharged at 150 ampere (a constant resistance discharge). For this test, a nichrome wire immersed in water was used. The end voltage was 9.0 volt. The battery was charged at 1.5 ampere to 15 volt.

3. RESULTS
Figure 1 shows the 12 ampere discharge tests. The Japanese battery had almost 30Ah for the initial several cycles, but after 7 cycles the capacity dropped to 22Ah. The capacity gradually decreased from 22Ah to 10Ah as shown in curve J or Figure 1. The Chinese GTP battery had a low initial capacity, about 24Ah but the capacity remained uncharged until about 80 cycles as seen in curve C or Figure 1.
Figure 2 shows 150 ampere discharge. The discharge curve J for Japanese battery had a high discharge capacity (375 sec) initially but the discharge time gradually decreased to 285 sec at the 17 cycles. The discharge time for the Chinese GTP battery (curve C) was only 310 sec initially, but it gradually increased to about 340

second at 10th cycle and remained almost uncharged until 17th cycles.

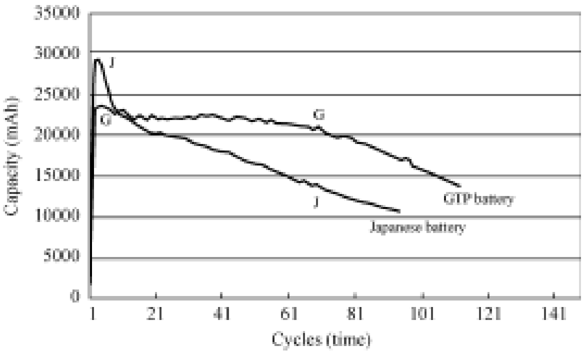

Fig. 1 12A discharge and 6A charge for 50B24 batteris (36Ah for 5hr)

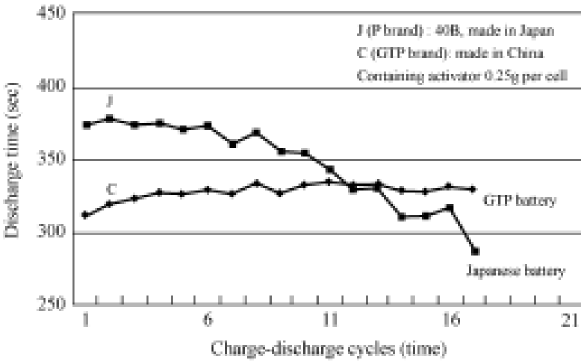

Fig. 2 Comparison for Japanese and Chinese batteries at 150A discharge

4. DISCUSSION

We need to explain why the Japanese battery has high capacity (about 29Ah) only for the first several cycles. This battery may has a special fine lead powder in order to meet the JIS specification for 5hr discharge. The Chinese battery's discharge time at 12 ampere is relatively low only 23Ah, but it remains unchanged to 70 cycles. For the practical cycle life, the expected Chinese battery life would be much better than the Japanese battery for the same size.

The better performance of the Chinese battery is believed to be due to the organic polymer added. The organic polymer molecules are adsorbed on the electrode surface and produce fine amorphous $PbSO_4$ and fine metallic lead at the negative electrode. We need to study the details of the beneficial action of the activator.

Figure 3 shows effect of ITE activator concentration for the Japanese batteries. The concentration range examined was 0.05g, and 1.0g per cell. Up to 16 cycles, the activator effect is not clear, but after the 18th cycles, the effect is clear. The more the activator added, the greater was the discharge capacity for the Japanese battery.

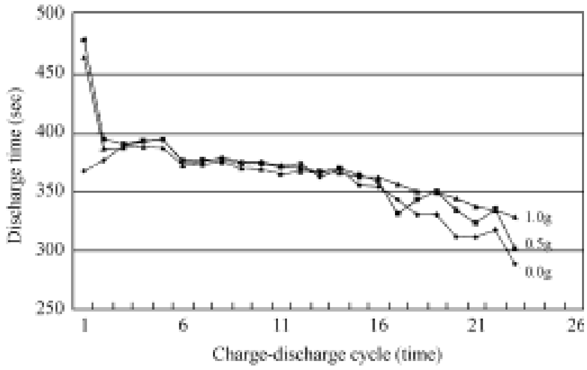

Fig. 3 Effect of activator concentration for 40B batteries (40Ah)

Figure 4 shows effect of discharge current, 60 ampere and 150 ampere continuous discharges. This discharge is carried out at a constant resistant, therefore, the current is not constant but the current change is small since the battery voltage is almost constant during the discharge. The two tests (60A and 150A), the activator added was very small amount (only 0.06g/cell). For this low concentration, the beneficial effect is small until 16 cycles. After 16th cycle the amount of ITE activator was increased to 0.26g/cell and 0.52g/cell. The high activator concentration cases had a clearly large beneficial effect (high discharge Ah).

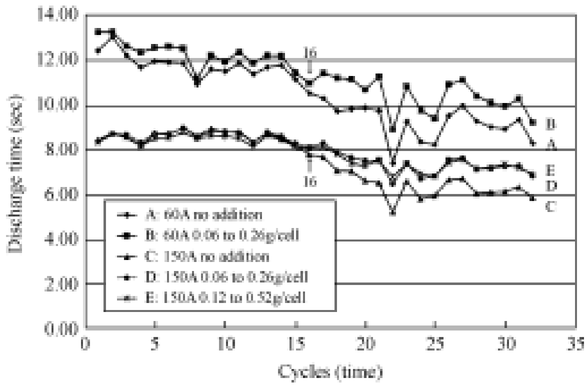

Fig. 4 Effect of concentration at 60A and 150A discharge

5. CONCLUSION

(1) ITE activator has clearly beneficial action both for the 60A and 150 ampere discharge for Japanese battery (Figure 4).

(2) The beneficial action increase with the increase of the activator concentration (Figure 3).

(3) With ITE activator, Chinese battery can exceed the performance of the best Japanese battery (Figure 1 and Figure 2).

References

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