

Plastic Plating process by Permanganate Etching Process

『CRP-MARS Process』

The plating technology on ABS resin which has been applying most widely in plating on plastics was already established, and industrialized by many job shops for plating. For the plastic plating process which has been applying practically today, the etching step composed of chromic acid and sulfuric acid is essential. By this etching treatment by chromic acid, butadiene on the ABS resin surface is oxidized and dissolved, and many fine pores form on the resin surface, and consequently, we can gain high adhesion of plating film. (anchor effect)

However, the hexa-valent chromium contained in this chromic acid etching solution is carcinogen and harmful to human body. And also, the hexa-valent chromium induces poor work environment and serious environmental pollution subject to waste solution and discharged water and has severe discharged water regulation standard. So there are many subject in its waste water treatment such as need high cost and others.

As the substitution material of chromic acid etching, we can introduce per-manganate salt. However, the conventional acidic permanganate solution has poor stability, and it is rather hard for us to use this bath continuously. We developed plastic plating process “CRO-MARS Process” which uses etching treatment by acidic permanganate solution having excellent bath stability.

CRP-MARS Process

Fig. 1 shows the treatment process of CRP-MARS Process. The etching solution is sulfuric acid base acidic solution containing low concentration permanganate salt. And also, CRP-MARS Process is direct acid copper plating method which does not use electroless plating solution containing waste water loading substances such as the conventional high concentration of phosphorus and chelating agent. By applying of plating by using CRP-MARS Process on ABS resin, the plating deposits on whole surface and we can gain plating film having high peeling strength of over 1 kgf/cm.

Fig. 2 shows the SEM image of ABS resin surface after etching treatment. As same as after chromic acid etching, the resin surface after CRP-MARS etching forms numerous fine pores of few μm. Therefore, in case of CRP-MARS Process, we can gain high adhesion by anchor effect.

To check the deterioration of etching solution by aging, we prepared the etching solutions of CRP-MARS Process and the conventional permanganate etching solution having simple bath composition, stayed them at 65 °C, and measured the peeling strength of the plating films gained by these stayed etching solutions and the concentration of permanganate in the etching solutions. We made relative comparison by making the concentration of permanganate at made-up as 100%. Fig. 3 shows these results. In case of the conventional permanganate etching solution, by staying for over 30 minutes, the peeling strength decreased and the concentration of permanganate decreased.

On the other hand, in case of the etching solution of CRP-MARS Process, even after staying for 120 minutes, the peeling strength was high at 1.3 kgf/cm and we could not observe the change of concentration of permanganate. By maintaining the concentration of permanganate in the etching solution uniform, it can give high peeling strength. The etching solution of CRP-MARS Process has extremely low fluctuation in the concentration of permanganate and can be applied continuously.

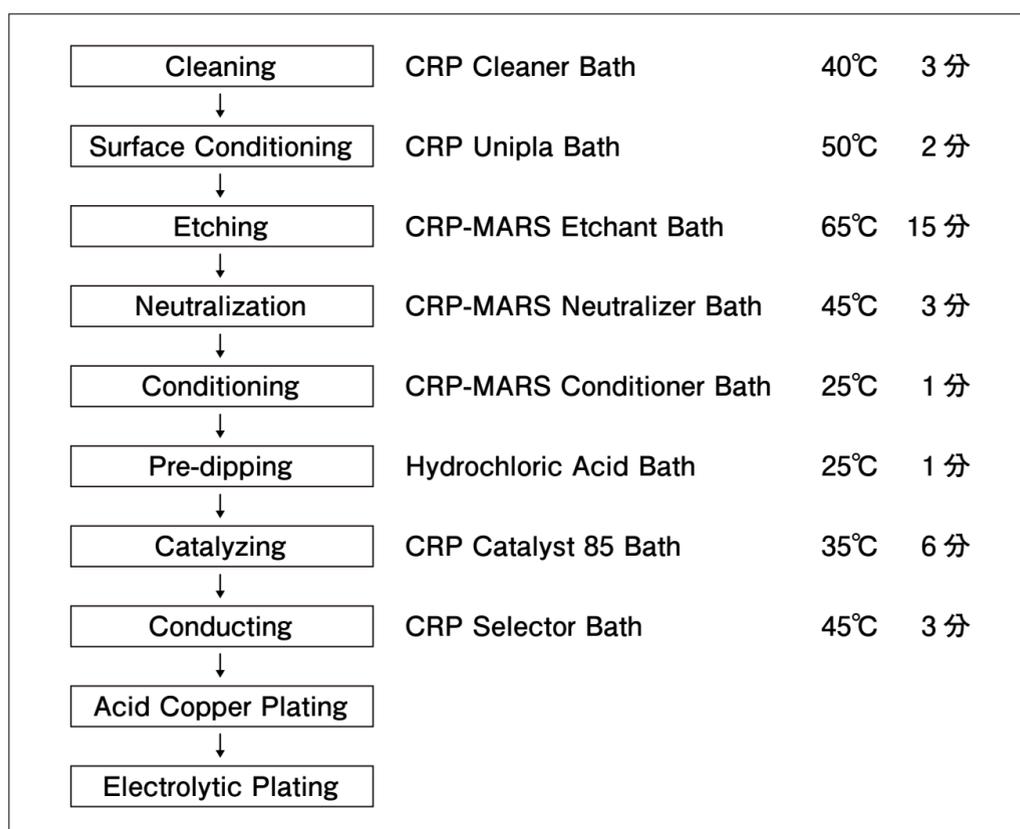


Fig.1 : Treatment Process of CRP-MARS Process

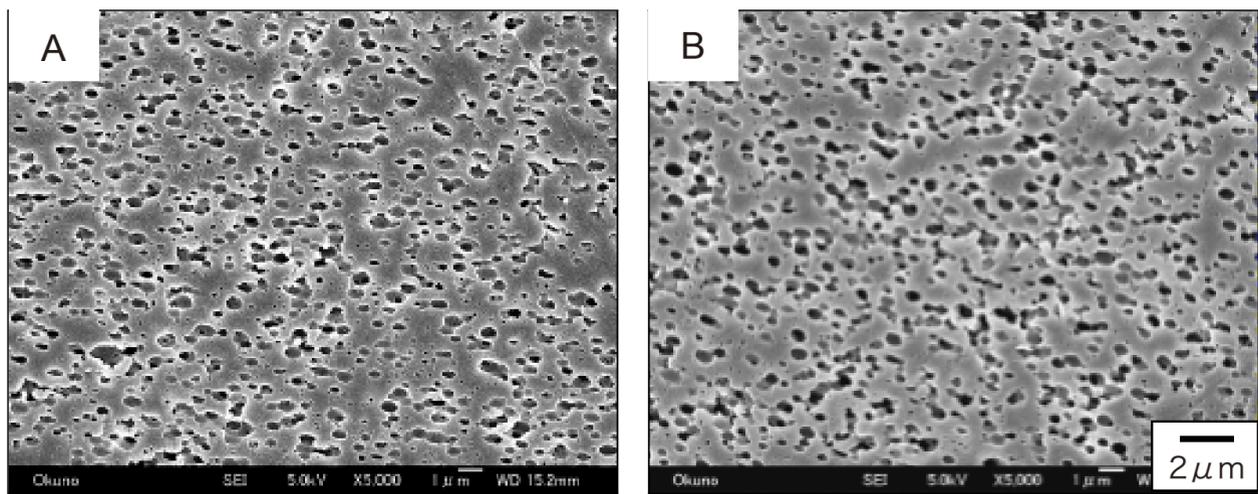


Fig.2 : SEM Image after Etching Treatment
(A) : CRP-MARS Etching, (B) : Chromic Acid Etching

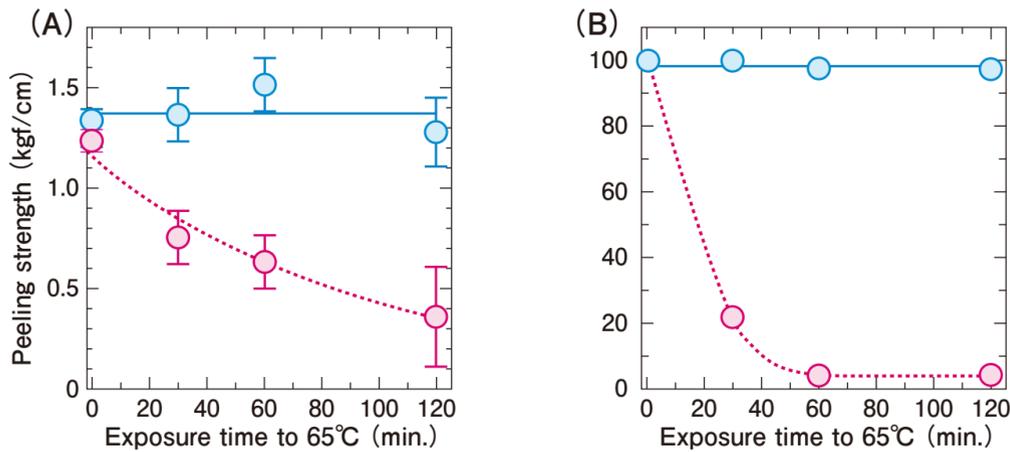


Fig.3 : Influence of Staying at 65 °C on Peeling Strength (A) and Concentration of Permanganate (B)
(○) : CRP-MARS Etching Solution, (○) : Conventional Permanganate etching Solution

Conclusion

Though chromic acid etching solution was applied for long period at plating on plastics, the substitution technology which is much friendly to environment is desired. The etching solution of CRP-MARS Process does not contain hexa-valent chromium and gives same level of plating film with chromic acid etching solution. Furthermore, the bath stability of the etching solution is extremely high, so we can expect this process to use at the industrial application.

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