

ELECTROLYTIC PREPARATION OF SODIUM AMALGAM

BY E. S. SHEPHERD

The ordinary electrolytic methods for making sodium amalgam¹ give a dilute amalgam and require a high voltage — fourteen volts in one case. As the electrolytic preparation of a solid sodium amalgam makes a very satisfactory lecture experiment, it seemed desirable to devise a method which would eliminate some of the difficulties. The chief reason why a solid amalgam is hard to obtain is that it has a lower density than mercury and rises to the surface. When the electrolyte is above the mercury, the solid or pasty amalgam separates the electrolyte from the mercury, cutting the current efficiency down very nearly to zero. To obviate this, the mercury was placed in a porous cup, the bottom of which dipped into the electrolyte. The amalgam then rises to the free surface, leaving fresh mercury in contact with the electrolyte. As soon as the whole mass becomes solid the sodium is no more readily absorbed, and the current efficiency drops off. Since a 1.5 percent amalgam is solid at 25° and a 2 percent amalgam is quite stiff at 100°, we should hardly expect to prepare a richer amalgam even though the 10 percent amalgam² only melts at 100°. A saturated sodium chloride solution was used with a platinum anode. The mercury was placed in a porous cup, the bottom of which dipped just below the surface of the solution. By this arrangement, electrical endosmose was decreased though not eliminated. Drops of water will pass through the diaphragm and these were removed, so far as possible, by means of filter paper. In one run melted naphthalene was placed on the surface of the mercury. This decreases oxidation and prevents sparking between

¹ Nernst. *Zeit. Elektrochemie*, **3**, 308 (1897); Kerp. *Zeit. anorg. Chem.* **17**, 300 (1898); Cf. Reuter. *Zeit. Elektrochemie*, **8**, 801 (1902).

² Kurnakow. *Zeit. anorg. Chem.* **23**, 439 (1900).

the surface of the amalgam and the moist walls of the cup. If the porous cup is boiled in the solution so as to get the walls thoroughly saturated, a run can be made with a mean potential difference of about seven volts. If this precaution is not taken, the voltage may rise to fourteen volts and there will be occasional sparking between the mercury and the walls of the cup. The following runs were made. The second column gives the temperature, the third the voltage, the fourth the current density in amperes per square decimeter, the fifth the concentration of the amalgam, and the sixth the current efficiency. The absolute current was 1-4 amperes and was held practically constant in each run.

No.	Temp.	Volts	N.D. ₁₀₀	Pct. Na	Efficiency
1	30°	5-8	10.5	0.5	28 pct
2	35°	6-8	18.3	1.5	37 pct
3	90°	5-7	19.0	1.3	29 pct
4	90°	—	4.0	0.3	65 pct
5	95°	6	7.8	1.6	60 pct

Run 5 was made with a covering of molten naphthalene above the amalgam. In all cases the porous cup is attacked by the caustic, especially after the amalgam grows pasty. The experiments show that a solid amalgam can readily be prepared electrolytically and that the yield is better at a higher temperature than at a lower. It seems probable that a better yield could be obtained at a lower voltage if a more satisfactory diaphragm were available.

Cornell University.