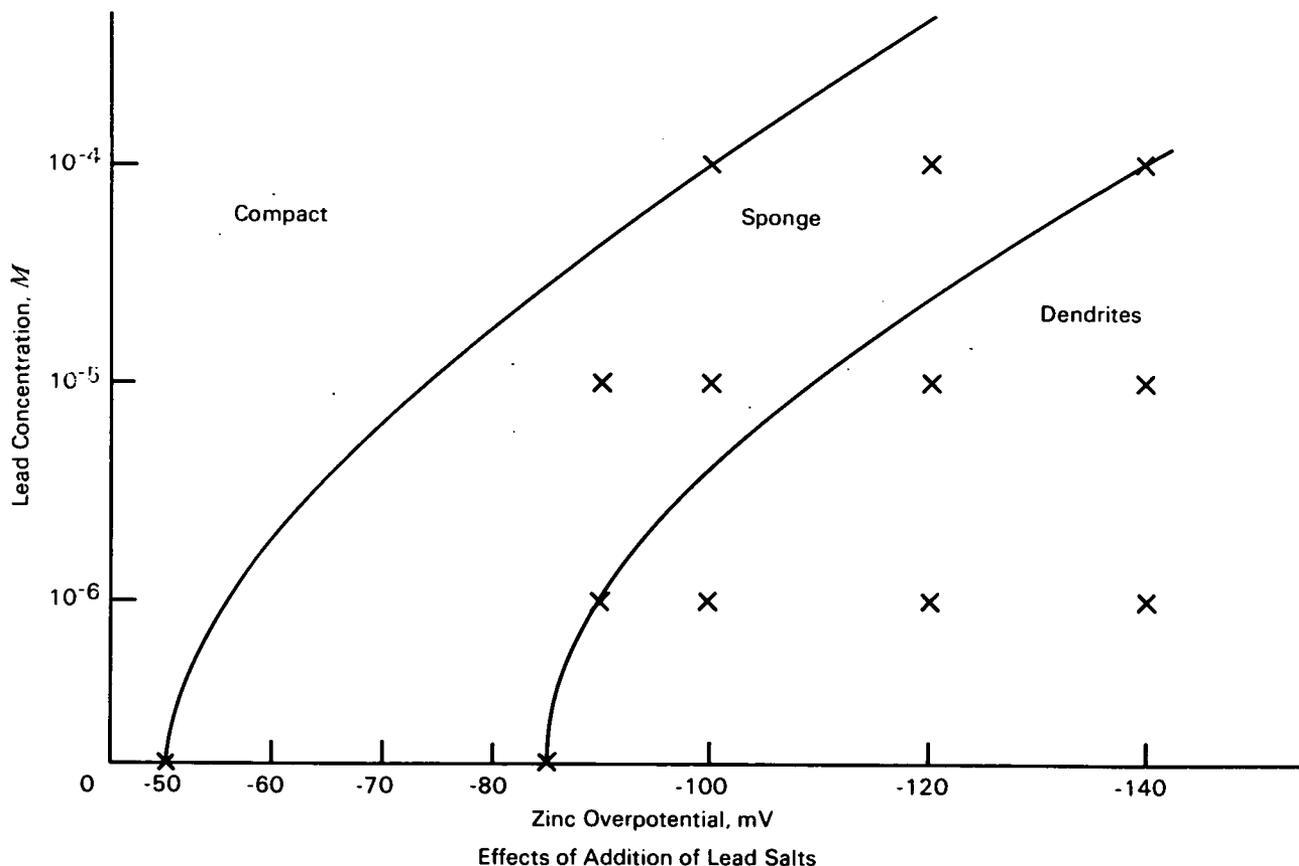


NASA TECH BRIEF



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Suppression of Zinc Dendrites in Zinc Electrode Power Cells



Addition of one of various tetraalkyl quaternary ammonium salts, to the alkaline zincate electrolyte of a cell, prevents formation of zinc dendrites during charging of the zinc electrode (see table); the electrode's capacity is not impaired. Elimination of dendrites prolongs the cell's life.

The fact that $0.2M$ Br^- (as KBr) is completely ineffective in preventing initiation of dendrites implies that the influence of the tetraalkyls is due to the adsorbed cation. The effect of the tetrapentyl cation on both initiation and propagation is exactly analogous to that of the same concentration of lead (see Tech Brief 70-10153). It is concluded that at the same

(continued overleaf)

concentration the tetrapentyl is as effective as lead at -100-mV overpotential.

Addition of soluble lead salts (acetate or nitrate) confirmed the results reported in Tech Brief 70-10153 (see fig.). At a lead concentration of $10^{-4}M$, dendrites are eliminated provided that the zinc overpotential does not exceed -140 mV.

It is proposed that adsorption of either lead ions or tetraalkyl cations interferes with the initiation of zinc dendrites because of the adsorption at certain preferential sites and of the slowing of the normally fast surface-diffusion step. The net result of these effects is formation of many very small grains rather than of fewer large grains that normally precedes initiation of dendrites.

Minimum concentrations of quaternary ammonium salts for complete suppression of zinc dendrites from an electrolyte of 10M zincate-10% KOH at 30°C and -100 mV. At higher concentrations the electrodeposit's morphology is always compact.

Quaternary salt	Minimum concentration, <i>M</i>
$(C_2H_5)_4NBr$	2×10^{-1}
$(C_3H_7)_4NBr$	2×10^{-2}
$(C_4H_9)_4NBr$	2×10^{-3}
$(C_5H_{11})_4NI$	2×10^{-4}

Note:

Requests for further information may be directed to:
Technology Utilization Officer
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National Aeronautics
and Space Administration
Washington, D.C. 20546
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Patent status:

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