3 Composition & Chemistry

3.1 Anode

The anode material in DURACELL® Li/ MnO_2 cells is pure lithium metal. Lithium, the lightest of all metals, has the highest electrode potential and offers the greatest ampere-hour capacity per-unit-weight. Table 2 illustrates the advantage that lithium offers in terms of weight and electrochemical equivalence.

ANODE MATERIAL	ATOMIC WEIGHT	AMPERE HOUR CAPACITY PER GRAM (Ah /g)
Pb	207.19	0.26
Zn	65.37	0.82
Fe	55.85	0.96
Li	6.94	3.86

TABLE 2 *Lithium versus other anode materials*

3.2 Cathode

The cathode material used in DURACELL® Li/ MnO_2 cells is a mixture of heat-treated electrolytic manganese dioxide and conductive agents blended together for high conductivity. The conductivity of the MnO_2 cathode results in higher initial cell voltage and operating voltage during discharge than that achieved when using highly-resistive active cathode materials, such as poly-carbonmonofluoride. The thermodynamic stability of this specially processed MnO_2 cathode ensures high reliability and performance, even after very long periods of storage.

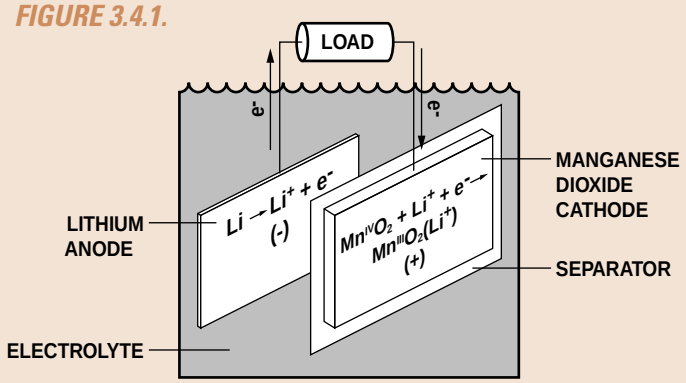
3.3 Electrolyte

The electrolyte in DURACELL® Li/MnO_2 cells is an organic solvent mixture into which an alkali metal salt is dissolved. This solution is a stable, nonpressurized medium which balances the attributes of reliability, long life, performance, and safety. High ionic conductivity and low viscosity permit efficient cathode utilization over a wide range of temperatures, even at high rates of discharge.

3.4 Cell Reaction

The cell reaction involves the oxidation of lithium metal at the anode to produce positively charged lithium ions (Li^+) and electrons (e^-), as shown in Figure 3.4.1. Li^+ ions go into solution and diffuse through the electrolyte and separator to the cathode. Electrons travel through the external circuit and arrive at the cathode where MnO_2, Li^+ ions and electrons combine. The MnO_2 is reduced from the tetravalent to the trivalent state. The solid discharge reaction product remains in the cathode. No gases are evolved during discharge to cause a pressurized condition.

FIGURE 3.4.1.



Li/MnO_2 total cell reaction:
$Li + Mn^{IV}O_2 \rightarrow Mn^{III}O_2(Li^+)$.