1. Introduction

The batteries most commonly used in existing cellular phones, personal computers, and other electronic devices are lithium-ion secondary batteries, and lithium cobaltate is the main cathode material for these devices. As cellular phones become more functionally powerful, however, a cathode material offering larger capacity, longer service life, and higher safety is required. The nickel-based cathode material has long been known to have larger capacity than lithium cobaltate and lithium manganate[1,2]. Nevertheless, nickel-based cathode material has rarely been used commercially for safety reasons, because oxygen is liberated from cathode material crystals as the temperature rises during overcharging, which could induce ignition and explosion. To solve this safety problem, JFE Mineral has developed special nickel-based cathode material: cobalt, aluminum, and other elements are added as well as nickel, to form $LiNi_{0.78}Co_{0.19}Al_{0.03}M_xO_2$ (Product No. 503LP), using JFE Mineral's exclusive technology for synthesizing composite oxides and for controlling compositions and crystals. The new nickel-based cathode material also offers good