



US 20230231177A1

(19) **United States**(12) **Patent Application Publication**
YAMAZAKI et al.(10) **Pub. No.: US 2023/0231177 A1**(43) **Pub. Date: Jul. 20, 2023**(54) **SECONDARY BATTERY AND A METHOD
FOR FABRICATING THE SAME****H01M 4/04** (2006.01)**H01M 4/139** (2006.01)(71) Applicant: **SEMICONDUCTOR ENERGY
LABORATORY CO., LTD.**, Atsugi-shi
(JP)**H01M 4/13** (2006.01)**H01M 4/36** (2006.01)(72) Inventors: **Shunpei YAMAZAKI**, Tokyo (JP);
Minoru TAKAHASHI, Matsumoto
(JP)(52) **U.S. Cl.****CPC** **H01M 10/0525** (2013.01); **H01M 4/621**
(2013.01); **H01M 4/0426** (2013.01); **H01M**
4/139 (2013.01); **H01M 4/13** (2013.01);
H01M 4/366 (2013.01); **H01M 4/0404**
(2013.01); **H01M 10/058** (2013.01)(21) Appl. No.: **18/114,389**(22) Filed: **Feb. 27, 2023****Related U.S. Application Data**(60) Division of application No. 17/315,766, filed on May
10, 2021, now Pat. No. 11,594,752, which is a con-
tinuation of application No. 15/697,585, filed on Sep.
7, 2017, now Pat. No. 11,005,123, which is a division
of application No. 14/245,037, filed on Apr. 4, 2014,
now Pat. No. 9,768,467.**Foreign Application Priority Data**

(30)

Apr. 19, 2013 (JP) 2013-088165

Publication Classification(51) **Int. Cl.****H01M 10/0525** (2006.01)**H01M 4/62** (2006.01)

(57)

ABSTRACT

The adhesion between metal foil serving as a current collector and a negative electrode active material is increased to enable long-term reliability. An electrode active material layer (including a negative electrode active material or a positive electrode active material) is formed over a base, a metal film is formed over the electrode active material layer by sputtering, and then the base and the electrode active material layer are separated at the interface therebetween; thus, an electrode is formed. The electrode active material particles in contact with the metal film are bonded by being covered with the metal film formed by the sputtering. The electrode active material is used for at least one of a pair of electrodes (a negative electrode or a positive electrode) in a lithium-ion secondary battery.

