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(54) **NANO-GRAPHITE PLATE STRUCTURE**

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,771,630 B2 * 7/2014 Wu et al. 423/448
2005/0271574 A1 * 12/2005 Jang et al. 423/448

* cited by examiner

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(57) **ABSTRACT**

The present invention relates to a nano-graphite plate structure with N graphene layers stacked together, where N is 30 to 300. The nanometer nano-graphite structure has a tap density of 0.1 g/cm^3 to 0.01 cm^3, a thickness of 10 nm to 100 nm, and a lateral dimension of 1 μm to 100 μm. The ratio of the lateral dimension to the thickness is between 10 and 10,000. The oxygen content is less than 3 wt %, and the carbon content is larger than 95 wt %. The nano-graphite plate structure has both the excellent features of the graphene and the original advantages of easy processability of the natural graphite so as to be broadly used in various application fields.

9 Claims, 3 Drawing Sheets