

(12) **United States Patent**
Yan et al.

(10) **Patent No.:** **US 9,410,077 B2**
(45) **Date of Patent:** **Aug. 9, 2016**

(54) **METHOD FOR PREPARING
ULTRA-LIGHT-WEIGHT (ULW) PROPPANT
APPLIED ON OIL AND GAS WELLS**

3,631,087 A * 12/1971 Lewis C08F 283/122
525/479

(Continued)

(71) Applicant: **CHINA UNIVERSITY OF
GEOSCIENCES (WUHAN)**, Wuhan,
Hubei (CN)

FOREIGN PATENT DOCUMENTS

CN 101346324 A 1/2009
CN 101605864 A 12/2009

(Continued)

(72) Inventors: **Chunjie Yan**, Hubei (CN); **Yixia Wang**,
Hubei (CN); **Tao Chen**, Hubei (CN);
Yonghan Zhang, Hubei (CN); **Yuting
Chen**, Hubei (CN); **Luru Jing**, Hubei
(CN)

OTHER PUBLICATIONS

Wang Yixia et al., Reinforced performances of polymethyl
methacrylate/silica fume composite spherical particles used as ultra-
lightweight proppants, Journal of Reinforced Plastics and Compos-
ites, pp. 1-12, 2015.

(Continued)

(73) Assignee: **CHINA UNIVERSITY OF
GEOSCIENCES (WUHAN)**, Wuhan,
Hubei (CN)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

Primary Examiner — Jeffrey Washville

(74) *Attorney, Agent, or Firm* — Tim Tingkang Xia, Esq.;
Locke Lord LLP

(21) Appl. No.: **14/825,851**

(22) Filed: **Aug. 13, 2015**

(65) **Prior Publication Data**

US 2016/0046856 A1 Feb. 18, 2016

(30) **Foreign Application Priority Data**

Aug. 13, 2014 (CN) 2014 1 0398511

(51) **Int. Cl.**
C09K 8/80 (2006.01)

(52) **U.S. Cl.**
CPC **C09K 8/80** (2013.01); **C09K 2208/10**
(2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,334,062 A * 8/1967 Brown C01G 5/00
106/490

(57) **ABSTRACT**

A method for preparing an ultra-light-weight (ULW) prop-
pant usable in the oil and gas industry. The method uses silane
coupling agent and organic acid to modify silica fume (SF) to
obtain modified SF that is lipophilic and hydrophobic. The
modified SF is used as inorganic phase, and the polymeriz-
able monomer is used as organic phase, and the organic-
inorganic composite microspheres are obtained through sus-
pension polymerization. The ULW proppant is obtained by
drying, screening, and pre-oxidization of the composite
microsphere. The ULW proppant has a density of about 1.109
g/cm³-1.278 g/cm³, which is close to that of water, a crushing
rate of <5% at 52 Mpa, and a crushing rate of <7% at 69 Mpa.
In the oil and gas industry application, water or salt water can
be used to replace the high viscose guanidine gum as carrier,
thus reduced cost of fracturing, and reduced environment
pollution.

16 Claims, 2 Drawing Sheets

