

Title (en)  
SYSTEMS AND METHODS FOR NANOFUNCTIONALIZATION OF POWDERS

Title (de)  
SYSTEME UND VERFAHREN ZUR NANOFUNKTIONALISIERUNG VON PULVERN

Title (fr)  
SYSTÈMES ET PROCÉDÉS DE NANOFONCTIONNALISATION DE POUDRES

Publication  
**EP 3661680 A4 20210106 (EN)**

Application  
**EP 18840807 A 20180603**

Priority  
• US 201762540616 P 20170803  
• US 201815996439 A 20180602  
• US 2018035766 W 20180603

Abstract (en)  
[origin: WO2019027563A1] Some variations provide a system for producing a functionalized powder, comprising: an agitated pressure vessel; first particles and second particles contained within the agitated pressure vessel; a fluid contained within the agitated pressure vessel; an exhaust line for releasing the fluid from the agitated pressure vessel; and a means for recovering a functionalized powder containing the second particles disposed onto surfaces of the first particles. A preferred fluid is carbon dioxide in liquefied or supercritical form. The carbon dioxide may be initially loaded into the pressure vessel as solid carbon dioxide. The pressure vessel may be batch or continuous and is operated under reaction conditions to functionalize the first particles with the second particles, thereby producing a functionalized powder, such as nanofunctionalized metal particles in which nanoparticles act as grain refiners for a component ultimately produced from the nanofunctionalized metal particles. Methods for making the functionalized powder are also disclosed.

IPC 8 full level  
**B01J 3/02** (2006.01); **B01J 3/04** (2006.01); **B22F 1/16** (2022.01); **B22F 1/18** (2022.01); **B22F 9/02** (2006.01); **B22F 3/105** (2006.01); **C22C 1/10** (2006.01)

CPC (source: EP US)  
**B01J 3/002** (2013.01 - EP); **B01J 3/02** (2013.01 - EP); **B01J 3/04** (2013.01 - EP); **B22F 1/16** (2022.01 - EP US); **B22F 1/18** (2022.01 - EP US); **B22F 3/003** (2013.01 - EP); **B22F 9/02** (2013.01 - EP US); **C23C 14/223** (2013.01 - EP); **C23C 24/08** (2013.01 - EP); **B22F 10/20** (2021.01 - EP US); **B22F 2998/10** (2013.01 - EP); **B22F 2999/00** (2013.01 - EP); **B33Y 70/10** (2020.01 - EP); **C22C 1/10** (2013.01 - EP); **Y02P 10/25** (2015.11 - EP)

C-Set (source: EP US)  
**B22F 2999/00 + B22F 1/16 + B22F 1/18 + B22F 2202/03**

Citation (search report)  
• [XAI] US 6184270 B1 20010206 - BECKMAN ERIC J [US], et al  
• [XA] US 2005191491 A1 20050901 - WANG YULU [US], et al  
• [XA] US 5399597 A 19950321 - MANDEL FREDERICK S [US], et al  
• [XA] US 2017021427 A1 20170126 - WANG SHUZHONG [CN], et al  
• [XA] US 5725987 A 19980310 - COMBES JAMES R [CA], et al  
• [XA] US 2009186153 A1 20090723 - HERTZ AUDREY [FR], et al  
• [A] US 2006045787 A1 20060302 - JANDESKA WILLIAM F JR [US], et al  
• See also references of WO 2019027563A1

Cited by  
CN115845779A; US11154929B2

Designated contracting state (EPC)  
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

DOCDB simple family (publication)  
**WO 2019027563 A1 20190207**; CN 110997197 A 20200410; EP 3661680 A1 20200610; EP 3661680 A4 20210106

DOCDB simple family (application)  
**US 2018035766 W 20180603**; CN 201880050045 A 20180603; EP 18840807 A 20180603