US 20220361298A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2022/0361298 A1**

Hoff et al. (43) **Pub. Date: Nov. 10, 2022**

(54) **APPARATUS AND METHOD TO CONTROL ELECTROMAGNETIC HEATING OF CERAMIC MATERIALS**

(71) Applicant: **Government of the United States of America, as represented by the Secretary of the Air Force**, Kirtland AFB, NM (US)

(72) Inventors: **Brad Winston Hoff**, Albuquerque, NM (US); **David Michael French**, Portland, OR (US)

(21) Appl. No.: **17/853,343**

(22) Filed: **Jun. 29, 2022**

Related U.S. Application Data

(62) Division of application No. 15/605,846, filed on May 25, 2017, which is a division of application No. 14/205,354, filed on Mar. 11, 2014, now abandoned.

(60) Provisional application No. 61/780,636, filed on Mar. 13, 2013.

Publication Classification

(51) **Int. Cl.**

H05B 6/02	(2006.01)
H05B 6/46	(2006.01)
H05B 6/68	(2006.01)
H05B 6/00	(2006.01)
H05B 6/64	(2006.01)

(52) **U.S. Cl.**

CPC ***H05B 6/02*** (2013.01); ***H05B 6/46*** (2013.01); ***H05B 6/68*** (2013.01); ***H05B 6/00*** (2013.01); ***H05B 6/64*** (2013.01)

(57) **ABSTRACT**

An electrode is embedded in a piece of ceramic material having a population of conduction band electrons. Applying a voltage bias to the electrode causes electrons to flow towards or away from the electrode to form a positively charged sheath either a distance apart from or adjacent the electrode, depending the polarity of the bias. The electron flow also forms a negatively charged sheath lying opposite the positively charged sheath, and an electrically neutral region lying between the two sheaths. Electromagnetic radiation impinging the ceramic material heats the ceramic where the radiation is absorbed by the electron population. As the incident radiation is absorbed in proportion to the electron density, heating is increased in the negatively charged sheath, relative to the other parts of the ceramic material. The location of heating is controlled by controlling the magnitude and polarity of the voltage bias.