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Title: RECENT ADVANCES OF GRAPHENE-BASED NANOFLUIDS FOR THE APPLICATION IN SOLAR COLLECTORS

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Introduction

ESSENTIAL ENERGY

RENEWABLE ENERGY

ALL AUTHORS

EFFICENCY

21.46%

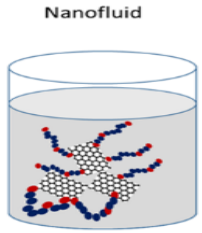
Verma et al. (2017)

ELECTRICAL POWER

108,854 TWh

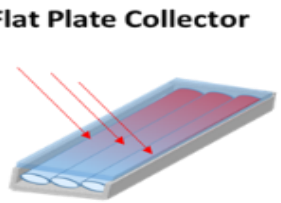
Shamshirgaran et al. (2018)

NANOFLUIDS



Nagarajan et al. (2014)
Chen et al.(2017)

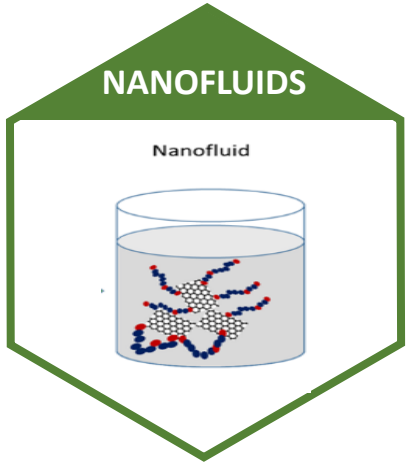
THERMAL ENERGY



Mahian et al. (2021)

GRAPHENE NANOFLUIDS SOLAR COLLECTOR

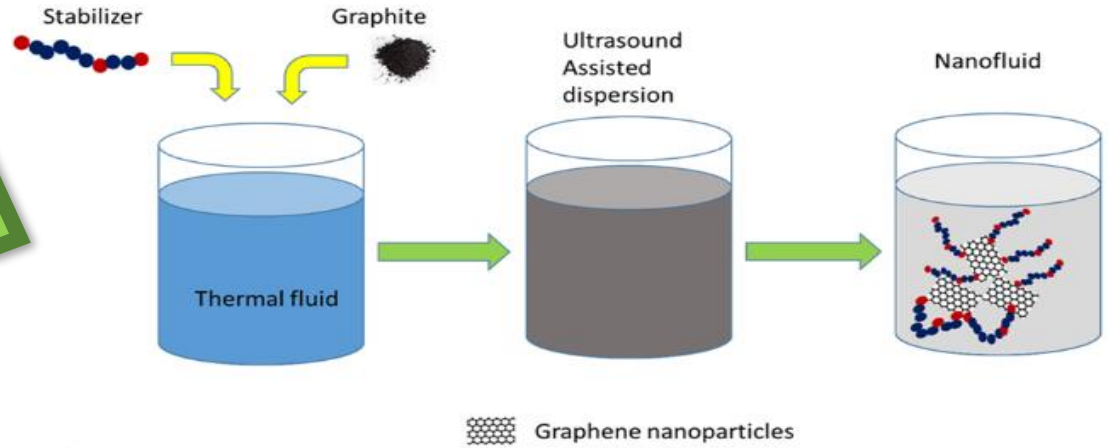
Nanofluids



Nagarajan et al. (2014)
Chen et al.(2017)

ONE-step process

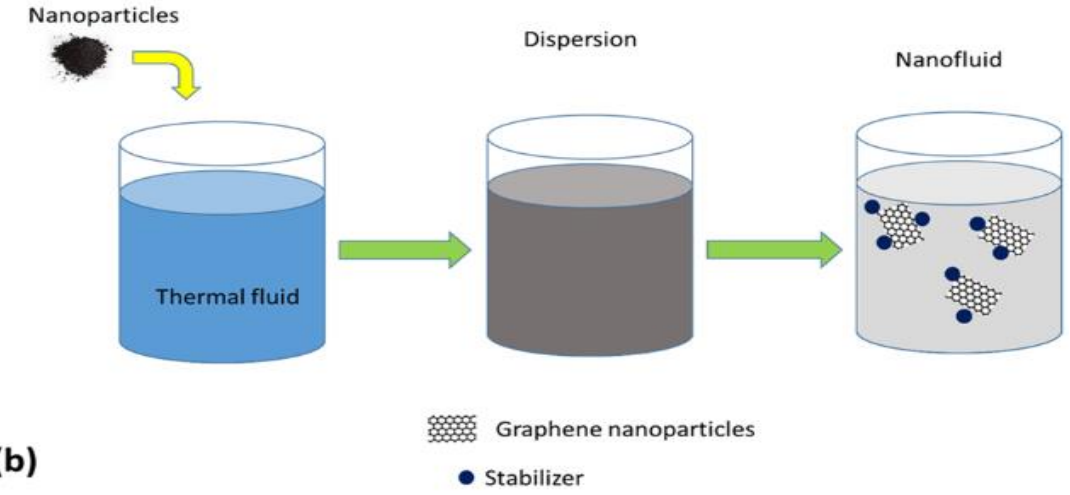
A



(a)

TWO-step process

B



(b)

GRAPHENE NANOFLUIDS SOLAR COLLECTOR

Two-phase system

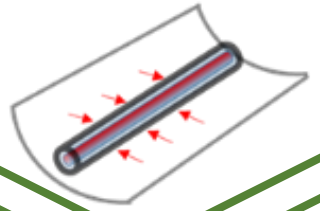
Types of solar collectors

THERMAL ENERGY

Non-Concentrating

- Flat plate solar collector
- Evacuated solar collector
- Direct absorption solar collector

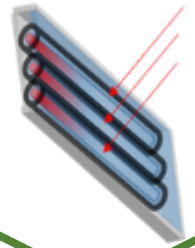
Parabolic Trough collector



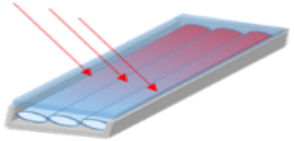
Concentrating

- Parabolic solar concentrator
- Fresnel solar collector
- Solar dish collector

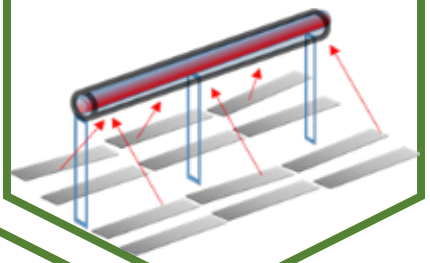
Evacuated tube collector



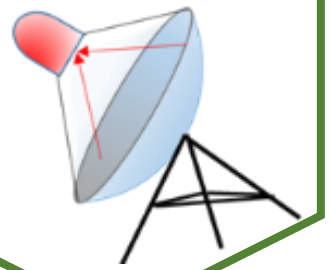
Flat Plate Collector



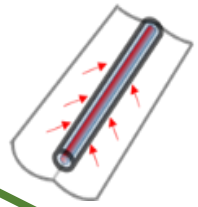
Linear Fresnel collector



Solar dish collector



Compound parabolic concentrator



GRAPHENE NANOFLUIDS SOLAR COLLECTOR

Recent applications of graphene-based nanofluids in solar collectors

Verma et al. (2017)

-Flat plate solar collector
-Graphene volume concentration of 0.75
-Water/graphene nanofluids

21.46%

Bioucas et al. (2018)

-Best performance in 0.1 wt.% graphene concentration
-Graphene and Water/ethylene glycol (70:30 % w/w) nanofluids

5.90%

Shende & Ramaprabhu (2017)

-Potential candidate for direct absorption solar collectors
-Graphene oxide/ethylene glycol nanofluids

17.8%

Chen et al.(2017)

-Potential candidate for direct absorption solar collectors
-Water/reduced graphene oxide nanofluids

33.6%

Wang et al. (2017)

-Potential candidate for direct absorption solar collectors
-Graphene/oil nanofluids

25%

GRAPHENE NANOFLUIDS SOLAR COLLECTOR

Thermal Enhancement

Current limitations of graphene based nanofluids

HUMMER´S METHOD → PRODUCTION → TIME → TOXIC CHEMICALS

NANOFLUIDS → WEAR OF INTERNAL SURFACES → TEST IN REAL CONDITIONS → RECYCLING OF THE NANOFLUIDS

GRAPHENE NANOFLUIDS SOLAR COLLECTOR

ECORFAN®