COOLING A TARGET USING ELECTRONS

RELATED APPLICATION

This application claims benefit under 35 U.S.C. § 119(e) to U.S. Provisional Application Serial No. 62/011,994, entitled "SYSTEM AND METHOD FOR COOLING A TARGET," filed June 13, 2014, the entire content of which is incorporated herein by reference.

TECHNICAL FIELD

This invention relates generally to thermodynamics, and more particularly to cooling a target using electrons.

BACKGROUND

Certain applications may include targets that are heated to a temperature that causes deformation of the material of the target. However, deformation of the target adversely affects performance and efficiency, and may result in failure.

SUMMARY OF INVENTION

According to a first aspect of the present invention, there is provided a method, comprising: impinging a plurality of particles on a target such that electrons are emitted from the target; transporting the electrons from the target to a heat sink through a transporting medium, wherein the target and the heat sink are separated by a distance; cooling the electrons using the heat sink; receiving a temperature of the target; and controlling flow of the electrons from the heat sink back to the target based at least in part on the received temperature.

According to a second aspect of the present invention, there is provided a system, comprising: a heat sink configured to cool electrons, the electrons being emitted from a target in response to an impingement of a plurality of particles on the target, wherein the heat sink and the target are separated by a distance; a return member configured to return the electrons from the heat sink to the target, the return member configured to couple to the heat sink and the target; and a processor configured to control flow of the electrons from the heat sink back to the target based at least in part on a temperature of the target.

According to a third aspect of the present invention, there is provided a system, comprising: a heat sink configured to cool electrons, the electrons being emitted from a leading edge of a wing of an aerial vehicle in response to an impingement of air on the leading edge of the wing, wherein the heat sink is separated from the leading edge of the wing by a distance; a return member configured to return the electrons from the heat sink to the leading edge of the wing, the return member configured to couple to the heat sink and the leading edge of the wing; and a processor configured to control flow of the electrons from the heat sink back to the target based at least in part on a temperature of the target.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present disclosure and for further features and advantages thereof, reference is now made to the following description taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a diagram illustrating an example environment in which electrons of a target are cooled, according to certain embodiments of the present disclosure;

FIGURE 2 is a diagram illustrating an example embodiment in which the target of FIGURE 1 may be a leading edge of a wing of an aerial vehicle, according to certain embodiments of the present disclosure.

WHAT IS CLAIMED IS:

1. A method, comprising:

impinging a plurality of particles on a target such that electrons are emitted from the target;

transporting the electrons from the target to a heat sink through a transporting medium, wherein the target and the heat sink are separated by a distance;

cooling the electrons using the heat sink;

receiving a temperature of the target; and

controlling flow of the electrons from the heat sink back to the target based at least in part on the received temperature.

2. The method of Claim 1, wherein the target comprises a leading edge of a wing of an aerial vehicle.

3. The method of Claim 1 or 2, wherein the target comprises an electrically emissive material.

4. The method of any one of the preceding claims, wherein a ratio of a cross-sectional area of the heat sink to a cross-sectional area of the target is greater than one.

5. The method of any one of the preceding claims, wherein the plurality of particles comprise air.

6. The method of any one of claims 1 to 4, wherein the plurality of particles comprise a plurality of protons.

7. The method of any one of the preceding claims, wherein the electrons are returned from the heat sink to the target using a wired connection.

8. The method of any one of the preceding claims, wherein the plurality of particles are impinged on the target using a particle accelerator.

9. The method of any one of the preceding claims, further comprising cooling the heat sink using a coolant.

10. The method of Claim 9, further comprising:

measuring a first temperature of the target using a first temperature sensor;

measuring a second temperature of the heat sink using a second temperature sensor; and

determining whether to adjust a rate of flow of the coolant from a cooling device to the heat sink based on the first temperature and the second temperature.

11. A system, comprising:

a heat sink configured to cool electrons, the electrons being emitted from a target in response to an impingement of a plurality of particles on the target, wherein the heat sink and the target are separated by a distance;

a return member configured to return the electrons from the heat sink to the target, the return member configured to couple to the heat sink and the target; and

a processor configured to control flow of the electrons from the heat sink back to the target based at least in part on a temperature of the target.

12. The system of Claim 11, wherein the target comprises a leading edge of a wing of an aerial vehicle.

13. The system of Claim 11 or 12, wherein the target comprises an electrically emissive material.

14. The system of any one of claims 11 to 13, wherein a ratio of a cross-sectional area of the heat sink to a cross-sectional area of the target is greater than one.

15. The system of any one of claims 11 to 14, further comprising a cooling device configured to cool the heat sink using a coolant.

16. The system of Claim 15, further comprising:

a first temperature sensor configured to measure a first temperature of the heat sink;

a second temperature sensor configured to measure a second temperature of the target; and

a processor configured to determine whether to adjust a rate of flow of the coolant from the cooling device to the heat sink based on the first temperature and the second temperature.

17. A system, comprising:

a heat sink configured to cool electrons, the electrons being emitted from a leading edge of a wing of an aerial vehicle in response to an impingement of air on the leading edge of the wing, wherein the heat sink is separated from the leading edge of the wing by a distance;

a return member configured to return the electrons from the heat sink to the leading edge of the wing, the return member configured to couple to the heat sink and the leading edge of the wing; and

a processor configured to control flow of the electrons from the heat sink back to the target based at least in part on a temperature of the target.

18. The system of Claim 17, wherein the return member comprises a wired connection between the heat sink and the leading edge of the wing.