SUMMARY OF THE DISCLOSURE

[0006] The present disclosure relates to systems and methods of controlling the temperature and humidity of a defined space. More specifically, the present disclosure is directed to systems and methods employing a two-phase process for pre-cooling air prior to dehumidification. In an embodiment of the present disclosure, external air is passed through a dry channel of a heat exchanger for pre-cooling prior to undergoing dehumidification. Any additional energy requirements for the heat exchanger are reduced or eliminated by simultaneously passing conditioned air through a wet channel of the heat exchanger prior to venting the conditioned air to the environment. Liquid in the wet channel evaporates into the exhausted, conditioned air, cooling the channel. The wet channel is thermally coupled to the dry channel, thereby cooling the dry channel and initially cooling and dehumidifying the external air before it enters the dehumidifier for additional dehumidification.

[0006a] An aspect of the present disclosure provides an air conditioning system for conditioning air in a space, comprising: a heat exchanger comprising: a first channel; a second channel; wherein a wall of the first channel and adjacent wall of the second channel form a shared, thermally coupled wall; a dehumidifier operatively connected to the second channel; and a conditioned space operatively connected to the first channel.

[0006b] Another aspect of the present disclosure provides a method of conditioning a space by using a heat exchanger, dehumidifier, and a conditioned space, the method comprising the steps of: drawing ambient air through a dry channel to precondition the ambient air; passing the pre-conditioned ambient air through a dehumidifier to condition the ambient air and delivering the conditioned air to a conditioned space; expelling the conditioned air through a wet channel, the wet channel having a first wall thermally coupled to a second wall of the dry

channel, the conditioned air evaporating liquid disposed along the first wall of the wet channel and reducing the temperature of the dry channel.

[0006c] Another aspect of the present disclosure provides a heat exchanger as a system for conditioning air, the heat exchanger comprising: a wet channel to draw conditioned air from a conditioned room through an inlet and discharge the conditioned air through an outlet located on the opposite end of the wet channel, the wet channel comprising a shared thermally coupled wall with the dry channel; a dry channel to draw ambient air through an inlet and discharge the ambient air through an outlet located on the opposite end of the dry channel and toward a dehumidifier; and wherein the passage of conditioned air through the wet channel evaporates liquid within the wet channel to cool the wet channel and the dry channel transfers heat to the wet channel and modulates the ambient air to a desired condition as the ambient air passes through the dry channel.

[0006d] Another aspect of the present disclosure provides an air conditioning system for conditioning air in a space, comprising: a heat exchanger comprising: a first channel; a second channel; wherein a wall of the first channel and adjacent wall of the second channel form a shared, thermally coupled wall; a dehumidifier operatively connected to the second channel; a conditioned space operatively connected to the first channel; a first inlet proximate a first end of the first channel, the first inlet configured to draw conditioned air from the conditioned space; a first outlet proximate a second end of the first channel, the first outlet configured to expel the conditioned air; a second inlet proximate a first end of the second channel, the second inlet configured to intake ambient air; a second outlet proximate a second end of the second channel, the second outlet configured to deliver ambient air to the dehumidifier, wherein the dehumidifier comprises a means to receive and dehumidify the ambient air to a desired condition prior to delivering the ambient air to the conditioned space; a liquid is disposed within the first channel, the liquid interacting with the conditioned air and reducing the temperature

on the first channel side of the shared thermally coupled wall and wherein the second channel transfers heat through the thermally coupled wall to the first channel, reducing the temperature of the second channel and cooling the ambient air.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The following detailed description, given by way of example, but not intended to limit the disclosure solely to the specific embodiments described, may best be understood in conjunction with the accompanying drawings.

[0008] FIG. 1 shows a diagram of the air conditioning system comprising a heat exchanger, dehumidifier, conditioned room, and the airflow into and out of the system.

[0009] FIG. 2 displays a first embodiment of the system of FIG. 1 comprising a heat exchanger with a plurality of channels.

FIG. 3 displays a second embodiment of the system of FIG. 1 comprising a heat exchanger with a plurality of channels.