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Development of a small capacity solar cooling absorption plant

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Abstract

Air conditioning systems has known a steady grow in recent decades which has a major impact on energy demand and environment. Systems using solar energy as fuel have been developed more than 100 years ago. The paper present such an alternative, prototype system, ammonia-water absorption refrigeration system (ARS) with minichannels powered by low temperature energy, using renewable sources for cooling. A short numerical calculation is made for determine the performance of the machine. The results obtained using EES program are presented and also first measurements on prototype machine.

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Keywords: absorption; solar cooling; minichannel.

1. Introduction

Currently, space heating and cooling together with water heating are estimated to account for nearly 60% of global energy consumption in buildings. They therefore represent the largest opportunity to reduce buildings energy consumption, improve energy security and reduce CO_2 emissions, particularly due to the fact that space and water heating provision in some countries is dominated by fossil fuels. Meanwhile, cooling demand is growing rapidly in countries with highly carbon-intensive electricity systems such as Association of Southeast Asian Nations, China and the United States [1]. Due to the negative impact on the environment as a result of the intensive use of fossil fuels,

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effects felt across the planet through global warming, the scientific community has shifted research towards a clean energy source and accessible all over the world, solar energy. Solar refrigeration systems has been evolved over 100 years and become more efficient. However, they still have to be improved in order to become competitive.

In Figure 1 are reviewed and classified the most popular and advanced processes for obtaining artificial cold that can use solar renewable energy. We will elaborate more on the use of one, namely the ammonia-water absorption system.

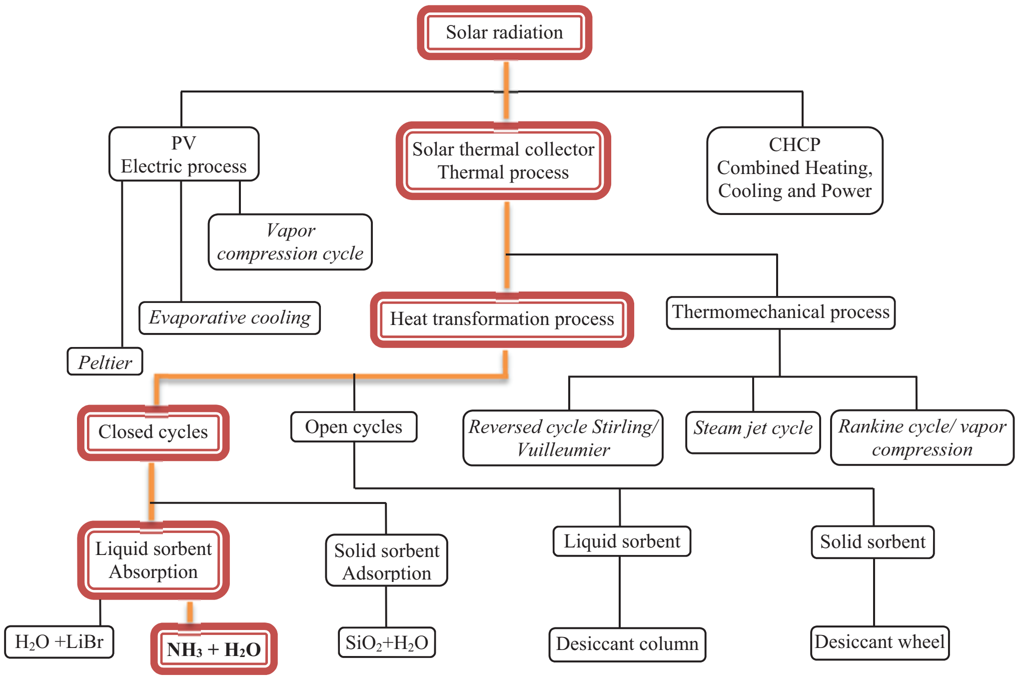

Fig. 1. Classification of the main processes that use solar energy for obtaining artificial cold [2, 3, 4, 5, 6].

Nomenclature

A	absorber	T	temperature(°C)
C	condenser	V	evaporator
CS	solar collector's	W	mechanical power (kW)
Co	consumer	x, ξ	mass fraction, concentration (kg/kg)
COP	coefficient of performance	η	efficiency
E	economizer		
f	circulation coefficient	Subscripts	
G	generator	a	absorber
h	enthalpy (kJ/kg)	c	condenser
LS	liquid separator	e	economizer
$\dot{m}$	mass flow (kg/s)	g	evaporator
P	pump	p	pump
p	pressure (bar)	0	evaporator
$\dot{Q}$	thermal power (kW)		
$\dot{q}_o$	specific capacity (kJ/kg)		