Abstract

Theoretical and experimental study has been conducted on steam condensation process on rotating disk condenser at different rotation speed and power supplied to the evaporation tank. The experimental investigation involved, special test apparatus designed and fabricated to realize the condensation process of the saturated steam on the upper surface of a disk whose base is kept at low temperature. The designed system ensures low temperature for the base of the disk equals to 5?. The heating element of the steam production sub-system is capable to work at different heating capacities (385, 270, 168 watt). The rotating system is capable to rotate the disc at different rotation speed ranging (103 -150 rpm). Proper slip-ring is fixed on this shaft to transfer the temperature signals from rotating disc to the read out device. The slip ring is used of 6-way mercury type. The experimental results showed that maximum condensate rate is ensured at rotation speed equals (N=150rpm), steam production power supply (Psteam=385watt) at cooling water temperature (Tcool=5?). It is observed that there is a gradual increase in condensate rate with increasing rotating speed. It is concluded that rotational speed increase leads to increase in the average heat flux across the disc, while local heat transfer is affected by the condensate layer thickness over the upper disc surface. The
disk surface temperature measured values decrease continuously in the radial direction and
disc average temperature is proportional with its rotational speed as maximum average
temperature is reached when this speed equals 150 rpm. The film thickness gradually
increases from center to outer portion of the disk based on both condensate rate and centrifugal
force that affects this thickness which in turn depend on the speed, cooling temperature, water
evaporation rate. The agreement between the experimental and theoretical overall heat
transfer coefficient appears to be reliable with a deviation of about (0.7-22%).

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Index Terms

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Keywords

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Theoretical and experimental study