

**STEAM QUALITY MEASUREMENTS
IN A HIGH PRESSURE SYSTEM**



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ABSTRACT

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The neutron scattering device has been successfully developed to measure steam quality in a two-phase steam-water flow. This technique is based on the fact that neutrons lose a significant amount of energy as they collide with hydrogen nucleus of the liquid phase in a two-phase steam-water flow. As a result, the amount of slowing-down neutrons is proportional to the amount of liquid or void fraction in the steam. Consistency of the developed scatterometer was checked with static experiments, which employed a solid material (lucite) to simulate the water fraction. Testing the device in the actual flow pipe showed that the density of compressed water was proportional to the neutron count rate.

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อุปกรณ์นิวตรอนสเคทเทอร์ริงเป็นอุปกรณ์ที่พัฒนาเพื่อวัดอัตราส่วนที่ว่าง หรือ สเต็มควอลิตีของของไหลที่ประกอบด้วยไอน้ำ และ น้ำที่ไหลภายในท่อ หลักการของการวัดคืออนุภาคนิวตรอนจะสูญเสียพลังงานเมื่อชนกับอนุภาคของไฮโดรเจนในน้ำ ดังนั้นจำนวนของอนุภาคนิวตรอนที่สูญเสียพลังงานนั้นเป็นสัดส่วนกับปริมาณของน้ำหรืออัตราส่วนที่ว่างในท่อ ความสามารถของอุปกรณ์ได้ถูกตรวจสอบในการทดลองแบบสแตติก ซึ่งเป็นการทดลองที่ใช้ลูโซท์เพื่อแทนที่ปริมาณน้ำภายในท่อ อีกทั้งได้มีการทดลองอุปกรณ์กับของไหลที่แท้จริง ซึ่งผลที่ได้คือความหนาแน่นของน้ำที่มีความดันสูงเป็นสัดส่วนกับจำนวนนิวตรอนที่วัดได้จากอุปกรณ์

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LIST OF SYMBOLS

CR	Contrast ratio
$N(1)$	Count rate at one lucite fraction
$N(\rho)$	Count rate at measured lucite fraction
$N(0)$	Count rate at zero lucite fraction
$\hat{\rho}$	Estimated lucite fraction
E_{th}	Thermal energy of neutron
k	Boltzmann's constant
T	Medium temperature
N_x	The sample average
ε	The standard error
$\% \Delta N_x$	The percentage of error