SOLISHTIRMA ISSIQLIK SIG'IMINI ANIQLASH USULLARI

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Annotatsiya: Ma'lumki, bugungi kunda energiyaga bo'lgan talab xar qachongidan ortgan zamonda, muqobil energiya resurslari qayta tiklanuvchi energiya manbalariga bo'lgan qiziqish ortadi, bu manbalarni o'rganishda solishtirma issiqlik sig'imini bilish muximdir. Shuning uchun bu ishda ularni aniqlash usullari keltirilgan.

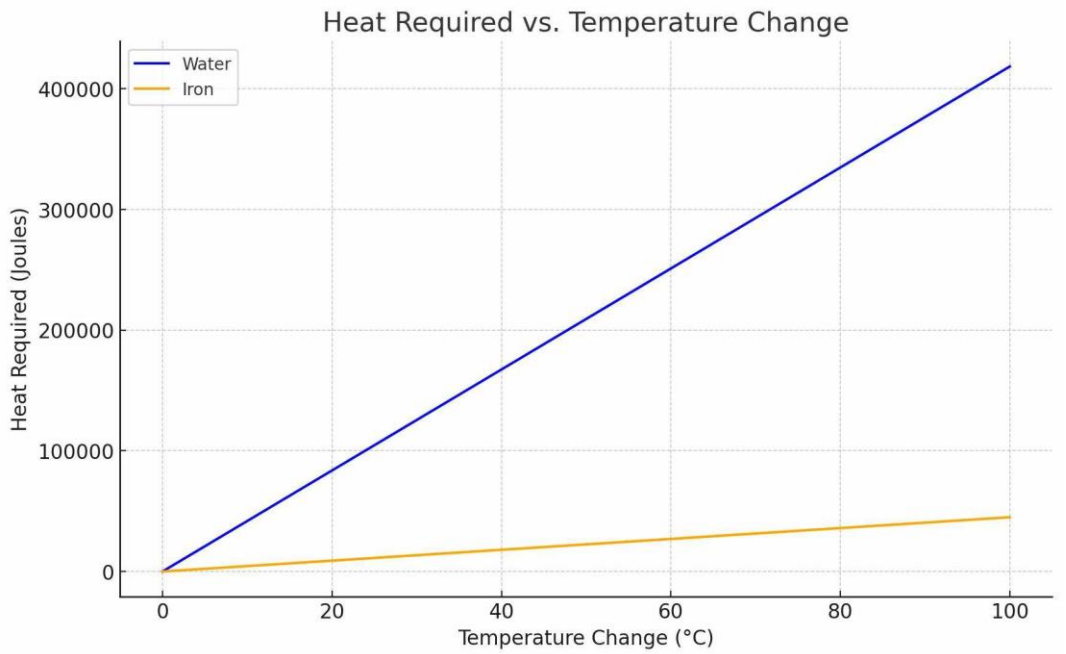
Kalit so'zlar: issiqlik sig'imi, solishtirma issiqlik sig'imi, molyar issiqlik sig'imi, faza, yashirin issiqlik miqdori, yashirin erish issiqligi, kalorimetriya, politropa, politropik jarayon,

Tajribalardan shu narsa aniqlandiki, sistema temperaturasini o'zgarishi uchun zarur bo'lgan issiqlik miqdori sistema massasi va temperatura o'zgarishiga to'g'ri proportsionaldir. Bu o'n sakkizinchi asrdayoq ma`lum edi. Massa, issiqlik sig'imi va temperatura o'zgarshi orasidagi munosabatni

$$Q = mc\Delta T$$

Ko'rinishda yozish mumkin.Bu yerda c-berilgan moddani xarakterlovchi kattalik bo'lib, solishtirma issiqlik sig'imi deyiladi.

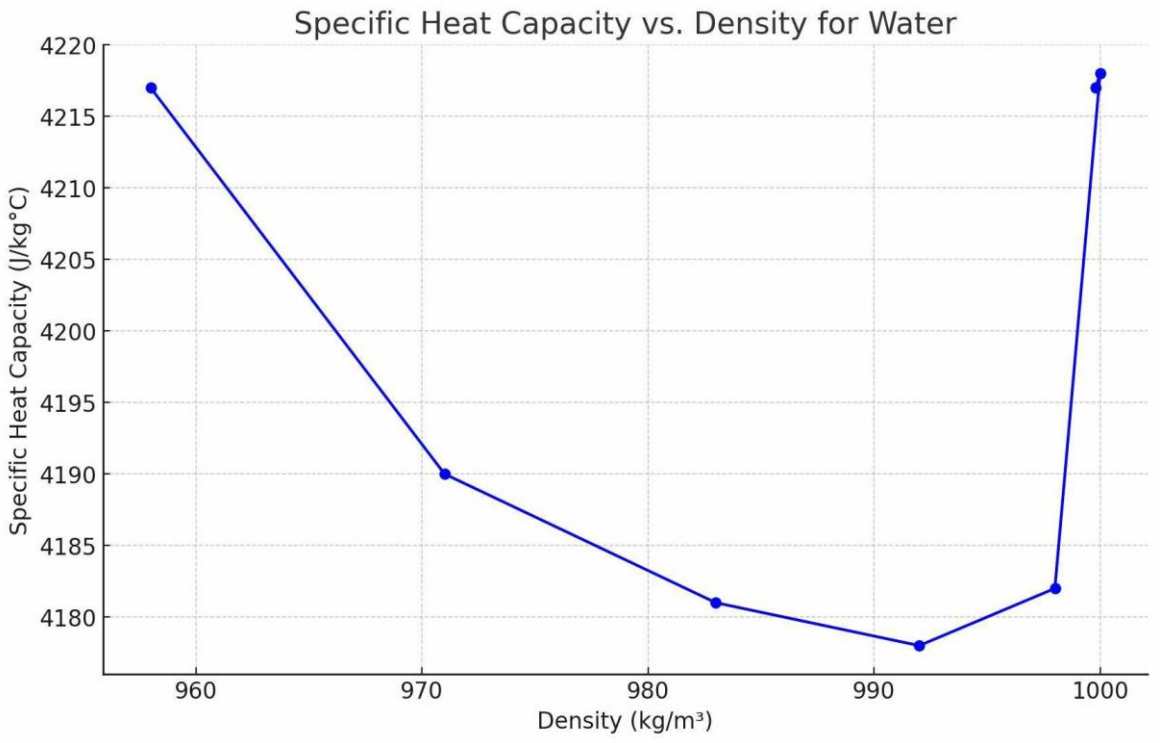
Birinchi rasmda suv va temirni harorat va issiqlik miqdori orasida bog'lanishni ko'rishimiz mumkin.



1-rasm

Issiqlik, bu temperaturalar farqi tufayli uzatilgan energiyadir. O'n yettinchi asr davomida Galiley, Nyuton va boshqa olimlar qadimgi grek olimlarining issiqlik energiyasini molekulyar harakatlar yuzaga keltiradi, degan nazariyasini quvvatlab kelganlar. Keyingi asrda temperatura farqi tufayli yuzaga keladigan energiya miqdorini xisoblash uchun usullar rivojlantirildi. Ikkita jism o'zaro bir-biri bilan kontaktga keltirilganida temperaturasi yuqoriroq jism temperaturasi pastroq jismga issiqlik berishi va bunda berilgan issiqlik olingan issiqlikka teng ekanligi topildi. Issiqlik-bu energiya uzatish usuli. Issiqlik issiqroq jismdan sovuqrog'iga uzatilganida, aynan energiya issiqrog'idan sovug'iga o'tadi. Demak, issiqlik-temperatura farqi tufayli bir jismdan ikkinchisiga o'tadigan energiyadir.

Suvning solishtirma issiqlik sig'imini zichlikka bog'lanish grafigi 2-rasmda keltirilgan.



2-rasm

Issiqlik harakatning alohida ko'rinishidir. Ayrim xolatlarda issiqlik mexanik ish tufayli, masalan, ikki jism bir-biriga ishqalishida, yuzaga keladi. Issiqlikning zamonaviy nazariyasi 1840 yillargacha noma`lum edi. (1818-1889) Jeyms Joul o'tkazgan tajribasi issiqlik ish singari energiya uzatish usuli ekanligi haqidagi zamonaviy tasavvur uchun asos bo'ldi. Osilgan jism lopatkalari bilan turbinani aylanishiga olib keladi. Lopatkani suyuqlik bilan ishqalanishi suyuqlik temperaturasining bir muncha oshishiga olib keladi. Joul ish issiqlik miqdoriga ekvivalent ekanini aniqladi. Ichki energiya barcha atomlar ilgarilanma harakati kinetik energiyalari yig'indisiga tengdir. Bu yig'indi bitta molekula o'rtacha kinetik energiyasining to'liq molekulalar soniga ko'paytmasiga tengdir. Issiqlik bu jismdagi

mavjud energiya bo'lmay, u sovuqroq jismdan issiqrog'iga uzatilayotgan energiyaning miqdoridir. Sistema temperaturasini o'zgartirish uchun zarur bo'lgan issiqlik miqdori Q sistema massasi m ga va temperatura o'zgarishi ΔT ga proportsional bo'lib, bu o'n sakkizinchi asrda ma`lum bo'ldi. Q, m va ΔT orasidagi bog'lanish

$$Q = \Delta E_{int} = C\,\Delta T = m\,c\,\Delta T \qquad (1)$$

ko'rinishga ega bo'lib, bu yerda S- issiqlik sig'imidir. Issiqlik sig'imi deb, modda temperaturasini 1 K ga oshirishdagi ichki energiyaning o'zgarishini ko'rsatuvchi fizik kattalikka aytiladi. Modda solishtirma issiqlik sig'imi issiqlik sig'imni modda mossasiga nisbati bilan aniqlanadi:

$$c = C/m \qquad (2)$$

Juda kichik bo'lsa ham, isitish uchun zarur bo'lgan issiqlik miqdori temperaturaga bog'liqdir. Yuqori temperaturalarni o'lchashning tarixiy birligi *kaloriyadir*. Bu birlik bir gramm suv temperaturasini bir gradusga oshirish uchun zarur bo'lgan issiqlik miqdori kabi aniqlanadi. Kaloriyaning SI sistemasidagi birligi Joul bo'lib, ular orasida:

$$1\ kal = 4{,}186\ J \qquad (3)$$

bog'liqlik mavjud.

Yuqori issiqlikning amerika o'lchov birligi **Btu** bo'lib, **britaniya issiqlik birligi deyiladi.** Britaniya issiqlik birligi bir funt suv temperaturasini 1 °F ga o'zgartirish uchun kerak bo'lgan issiqlik miqdoridir. Britaniya issiqlik birligi kaloriya va Joul bilan quyidagicha bog'langan:

$$1\ Btu = 252\ kal = 1.054\ kJ \qquad (4)$$

Suvning (suyuq xolatdagi) solishtirma issiqlik sig'imi:

$$s_{suv} = 1\frac{kal}{g \bullet K} = 1\frac{kkal}{kg \bullet K} = 4{,}184\ kJ/(kg \bullet K) \qquad (5a)$$

Xuddi shunday, britaniya issiqlik birligida issio`lik sig'imi

$$s_{suv} = 1\mathbf{Btu}/(1b \bullet °F) \qquad (5b)$$

kabi aniqlanadi.

Molyar issiqlik sig'imi (c') deb, bir mol modda temperaturasini bir gradusga isitish uchun kerak bhlgan issio`lik mio`doriga aytiladi,

$$c' = C/n$$

bu yerda n-mollar soni. C= m c ligidan, molyar issiqlik sig'imini solishtirma issiqlik sig'imi orqali ifodalash mumkin:

$$c' = C/n = m\,c/n = Mc \qquad (6)$$

bu yerda M= m /n bo'lib, molyar massadir.

1-jadvalda ayrim qattiq jism va suyuqliklarning solishtirma va molyar issiqlik sig'imlari qiymatlari keltirilgan. Metallarning molyar issiqlik sig'imlari qiymatlari bir-biriga yafinligiga e`tibor bering. Biz ushbu qiymatlar yordamida metallarning issiqlik sig'imi haqida mulohaza yuritamiz.

1-jadval

Ayrim qattiq jism va suyuqliklarning solishtirma va molyar issiqlik sig'imlari qiymatlari

Modda	S (kJ/kg•K)	S (kkal/kg •K) yoki Btu=(b•°F)	C' (J/mol•K)
Alyuminiy	0.900	0.215	24.3
Vismut	0.123	0.0294	25.7
Mis	0.386	0.0923	24.5
SHisha	0.840	0.20	—
Oltin	0.126	0.0301	25.6
Muz	2.05	0.49	36.9
Qo'rg'oshin	0.128	0.0305	26.4
Kumush	0.233	0.0558	24.9
Vol fram	0.134	0.0321	24.8
TSink	0.387	0.0925	25.2
Spirt(etil)	2.4	0.58	111
Simob	0.140	0.033	28.3
Suv	4.18	1.00	75.2
Bug' (1atm)	2.02	0.48	36.4

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