Seminární úloha 1.5

a) podíl: $N = \dfrac{a}{b}$, kde $a = \tilde{\tilde{\mu}}_a \pm u_a$, $b = \tilde{\tilde{\mu}}_b \pm u_b$

$$N = \frac{(\tilde{\tilde{\mu}}_a \pm u_a)}{(\tilde{\tilde{\mu}}_b \pm u_b)} \cdot \frac{(\tilde{\tilde{\mu}}_b \mp u_b)}{(\tilde{\tilde{\mu}}_b \mp u_b)} = \frac{\tilde{\tilde{\mu}}_a \tilde{\tilde{\mu}}_b \mp u_b \tilde{\tilde{\mu}}_a \pm u_a \tilde{\tilde{\mu}}_b \boxed{\pm u_a u_b}}{\tilde{\tilde{\mu}}_b^2 - u_b^2} \longleftarrow \text{řádově zanedbatelné}$$

$$N = \frac{\tilde{\tilde{\mu}}_a \tilde{\tilde{\mu}}_b \pm (u_a \tilde{\tilde{\mu}}_b + \tilde{\tilde{\mu}}_a u_b)}{\tilde{\tilde{\mu}}_b^2}$$

$$\Rightarrow \underline{\underline{u_N = \frac{u_a}{\tilde{\tilde{\mu}}_b} + \frac{\tilde{\tilde{\mu}}_a}{\tilde{\tilde{\mu}}_b^2} u_b}} \qquad \eta_N = \frac{u_N}{\tilde{\tilde{\mu}}_N} = \left( \frac{u_a}{\tilde{\tilde{\mu}}_b} + \frac{\tilde{\tilde{\mu}}_a}{\tilde{\tilde{\mu}}_b^2} u_b \right) \cdot \frac{\tilde{\tilde{\mu}}_b}{\tilde{\tilde{\mu}}_a}$$

$$\underline{\underline{\eta_N = \frac{u_a}{\tilde{\tilde{\mu}}_a} + \frac{u_b}{\tilde{\tilde{\mu}}_b}}} \quad \checkmark$$

b) mocnina: $N = a^m$, kde $a = \tilde{\tilde{\mu}}_a \pm u_a$

$$N = (\tilde{\tilde{\mu}}_a \pm u_a)^m = \binom{m}{0} \tilde{\tilde{\mu}}_a^m + \binom{m}{1} \tilde{\tilde{\mu}}_a^{m-1} u_a + \dots + \underbrace{\binom{m}{m} u_a^m}_{\text{řádově zanedbatelné}}$$

$$N = \tilde{\tilde{\mu}}_a^m + m \cdot \tilde{\tilde{\mu}}_a^{m-1} \cdot u_a$$

$$\Rightarrow \underline{\underline{u_N = m \cdot \tilde{\tilde{\mu}}_a^{m-1} \cdot u_a}} \qquad \eta_N = \frac{m \cdot \tilde{\tilde{\mu}}_a^{m-1} \cdot u_a}{\tilde{\tilde{\mu}}_a^m} = m \cdot \frac{u_a}{\tilde{\tilde{\mu}}_a} = m \cdot \eta_a$$

$$\underline{\underline{\eta_N = m \cdot \frac{u_a}{\tilde{\tilde{\mu}}_a}}} \quad \checkmark \; = m \cdot \eta_a$$

Seminární úloha 1.6

$\varrho = m/V$, $m = (8{,}930 \pm 0{,}002)\,kg$, $V = (1{,}002 \pm 0{,}001) \cdot 10^{-3}\,m^3$

$$u_\varrho = \frac{u_m}{\tilde{\tilde{\mu}}_V} + \frac{\tilde{\tilde{\mu}}_m}{\tilde{\tilde{\mu}}_V^2} \cdot u_V$$

$$u_\varrho = \left( \frac{0{,}002}{1{,}002 \cdot 10^{-3}} + \frac{8{,}930 \cdot 10^{-3}}{(1{,}002 \cdot 10^{-3})^2} \cdot 0{,}001 \right)\,kg \cdot m^{-3}$$

$$\underline{\underline{u_\varrho = 11{,}0 \; kg \cdot m^{-3}}}$$

$\tilde{\tilde{\mu}}_\varrho = \dfrac{\tilde{\tilde{\mu}}_m}{\tilde{\tilde{\mu}}_V}$ $\qquad\qquad \eta_\varrho = \dfrac{u_\varrho}{\tilde{\tilde{\mu}}_\varrho}$ $\qquad \varrho = \; ?$

$\tilde{\tilde{\mu}}_\varrho = \dfrac{8{,}930}{1{,}002 \cdot 10^{-3}} \; kg \cdot m^{-3}$ $\qquad \eta_\varrho = \dfrac{11}{8912} \cdot 100\,\%$

$\underline{\underline{\tilde{\tilde{\mu}}_\varrho = 8912{,}0 \; kg \cdot m^{-3}}}$ ? $\quad \underline{\underline{\eta_\varrho = 0{,}12\,\%}}$

Jedná se pravděpodobně o nikl s tabulkovou hodnotou hustoty

zaokrouhlením? $\qquad\qquad\qquad\qquad\qquad\qquad 8\,908 \; kg \cdot m^{-3}$

Martin Hanák

Seminární úloha 1.7

$S = \frac{\pi}{4} \cdot d^2$, kde $d = (1{,}26 \pm 0{,}02)$ mm

$u_S =$  $S = \frac{\pi}{4} \cdot (\tilde{\mu}_d^2 \pm 2 \cdot \tilde{\mu}_d \cdot u_d)$

$u_S = \frac{\pi}{4} \cdot 2 \tilde{\mu}_d \cdot u_d$

$u_S = \frac{\pi}{2} \cdot 1{,}26 \cdot 0{,}02 \ mm^2$

$\underline{\underline{u_S = 0{,}040 \ mm^2}}$  ✓

$\tilde{\mu}_S = \frac{\pi}{4} \tilde{\mu}_d^2$

$\tilde{\mu}_S = \frac{\pi}{4} \cdot (1{,}26)^2 \ mm^2$

$\underline{\underline{\tilde{\mu}_S = 1{,}247 \ mm^2}}$  ✓

$\eta_S = \frac{u_S}{\tilde{\mu}_S}$

$\eta_S = \frac{0{,}040}{1{,}247} \cdot 100 \%$

$\underline{\underline{\eta_S = 3{,}2 \%}}$

$S = ?$