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naar het werk van J. van Eldert

## Proef V.

2 a. massa steenkool "nat": 1,0023 g  
massa steenkool "droog": 0,971 g

→ gewicht v. vocht = 0,0313 g.

$$\rightarrow \frac{0,0313}{1,0023} \cdot 100 \% = 3,123 \%$$

b. massa steenkool = 2,0057 g.  
massa as = 0,3591 g

$$\rightarrow \text{asgehalte} = \frac{0,3591}{2,0057} \cdot 100 = 17,90 \%$$

c. 
$$V = \frac{100 \cdot (m_2 - m_3)}{m_2 - m_1} - M$$

$$= \frac{100 \cdot (14,6880 - 14,3930)}{14,6880 - 13,6794} - 3,123 = 26,125 \%$$

$$V_{\text{d.a.f.}} = \frac{V \cdot 100}{100 - (M+A)} = \frac{26,125 \cdot 100}{100 - (3,123 + 17,90)} = 33,08 \%$$

#### 4. HHV zonder correctiefactoren

Steenkool SBN 501. GB 28

$$S \text{ (gew \%)} = 2,3$$

$$C \text{ (gew \%)} = 65,6$$

$$65,6 + h + 0 + 2,3 + 17,90 + 3,123$$

" <sup>s</sup> " <sup>as</sup> " <sup>vocht</sup>

p. 53

$$\text{waterwaarde autobomb} = 10.945 \text{ J/K}$$

↳  $T_{\min}$  en  $T_{\max}$  v. binnenruimte

$$\Delta K = \Delta^\circ C = 23,232 - 21,000 = 2,232 \text{ K}$$

$$2,232 \cdot 10.945 = 24429,24 \text{ J}$$

$$\text{gew. briket} = 0,98375 - 0,0245 = 0,95925 \text{ g}$$

$$\Rightarrow \text{HHV} = 24429,24 / 0,95925 = 25,47 \text{ kJ/g}$$

5. ① Temperatuurcorrectie: kan niet toegepast worden want thermometer niet geijkt.

$$\text{② } C = n \cdot v' + \frac{v'' - v'}{t'' - t'} \left( \sum_1^{n-1} (t) + \frac{t_0 + t_n}{2} - n \cdot t' \right) = n \cdot v' + k \cdot S$$

koelcorrectie

hoofdperiode: p. 41

$$= 9 \text{ min.}$$

$$n = 9 \text{ min.}$$

$$v' = -0,003$$

$$v'' = 0$$

$$t' = 21,010$$

$$t'' = 23,232$$

$$t_1 = 21,750$$

$$t_2 = 22,780$$

$$t_3 = 22,958$$

$$t_4 = 23,135$$

$$t_5 = 23,189$$

$$t_6 = 23,219$$

$$t_7 = 23,226$$

$$t_8 = 23,230$$

$$t_9 = 23,230$$

$$t_{10} = 23,232$$

$$+ = 206,717$$

$$\sum_{i=1}^{n-1} (t_i) = 206,717$$

$$k = \frac{v'' - v'}{t'' - t'} = \frac{0 - 0}{23,232 - 21,010} = 0$$

$$t_0 = 21,020$$

$$t_n = 23,232$$

$$\rightarrow C = 9 \cdot -0,003 + \frac{0,003}{23,232 - 21,010} \left( 206,717 + \frac{21,020 + 23,232}{2} - 9 \cdot 21,010 \right)$$

$$\approx 0,0267 \text{ K}$$

③ Zuurcorrectie

$$Z_{\text{H}_2\text{SO}_4} = (V \cdot 15,1) - (0,7 \cdot 33) = 260,78$$

$$V = 18,8 \text{ ml.}$$

$$\rightarrow Z_{\text{tot}} = Z_{\text{H}_2\text{SO}_4} + 23,1 = 283,88 \text{ J}$$

④ Ontstekingscorrectie

$$1,0 \text{ g draad} = 1400 \text{ J}$$

$$0,0245 \text{ g draad} \rightarrow 34,3 \text{ J}$$

$$C = 0,0267 \text{ K} \quad \rightarrow + \text{ zuurcorrectie} \rightarrow$$

$$\text{CORR}_{\text{tot}} = 318,18 \text{ J}$$

$$\Delta T = 2,212 \text{ K}$$

$$\text{COR} \rightarrow + 0,0267 \text{ K}$$

$$\rightarrow \Delta T_{\text{COR}} = 2,2387 \text{ K}$$

gem. warmte-  
capaciteit  
↓

$$\text{vrijgekomen warmte} = 2,2387 \cdot 10945 = 24502,57 \text{ J}$$

$$\text{gew. bricket} = 0,95925 \text{ g}$$

$$\text{vrijgekomen warmte} + \text{correctie} = 24502,57 + 318,18 \text{ J} = 24820,75 \text{ J}$$

$$\rightarrow 25,875 \text{ MJ/kg.} = \text{HHV as received.}$$

w/o moisture:

$$\text{bricket massa} = 0,95925 - (0,03123 \cdot 0,95925) = 0,9293 \text{ g}$$

$$\rightarrow \text{HHV w/o moisture} = 26,709 \text{ MJ/kg}$$

$$6. \text{HHV}_{\text{corr}} (\text{as received}) = 25,075 \text{ MJ/kg}$$

$$\text{HHV} (\text{as received}) = 25,47 \text{ MJ/kg}$$

$$\rightarrow \text{relatieve fout} = 1,6\%$$

$$p. 36 \quad 7. \text{HHV} = 328c + 1429 \left( h - \frac{o}{8} \right) + 93s$$

$$c = 65,6\%$$

$$s = 2,3\%$$

$$o = h$$

$$100 = 65,6 + 2,3 + o + h$$

$$\rightarrow o = h = 16,05\%$$

$$\rightarrow \text{HHV} = 41,799 \text{ kJ/g}$$

$$\text{NCP} = 328c + 1204h + 93s - 178,625o - 25v$$

$$= 328 \cdot 65,6 + 1204 \cdot 16,05 + 93 \cdot 2,3 - 178,625 \cdot 16,05 - 25 \cdot 3,123$$

$$= 38,110 \text{ kJ/g}$$

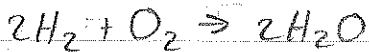
$$p. 36 \quad 8. \Delta Q_{\text{verd}} = 225h + 25v$$

$$= 3689,325 \text{ kJ/kg}$$

$$\text{Stookwaarde} = \text{HHV} - \Delta Q_{\text{verd}}$$

$$\Rightarrow = 41,799 - 3,689 = 38,11 \text{ kJ/g}$$

9. 14 g  $O_2$  verbruikt.



gew. briketje = 0,95925 g

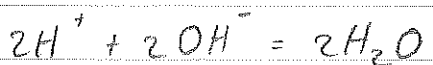
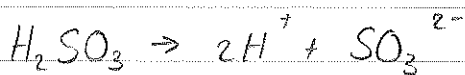
$$\begin{aligned} \rightarrow C &: 0,656 \cdot \frac{0,95925}{12} = 0,0524 \text{ mol } O_2 \\ S &: 0,023 \cdot \frac{0,95925}{32} = 0,000689 \text{ mol } O_2 \\ H &: 0,1605 \cdot \frac{0,95925}{2} = 0,07698 \text{ mol } O_2 + \end{aligned}$$

0,13 mol  $O_2$  verbruikt

14 g  $O_2 = 0,4375$  mol er in gestopt.

$$\rightarrow \frac{0,13}{0,4375} \cdot 100\% = 29,7\% O_2 \text{ verbruikt}$$

10. Zuurcorrectie = 260,78 J ongecorrigeerd  
283,88 J gecorrigeerd



↳ 18,8 ml 0,1 M toegevoegd  
→ 1,88 mmol  $OH^-$

$$\begin{array}{l|l} 283,88 & \times 1,88 \text{ mmol} \\ 260,78 & | 1,73 \text{ mmol} \end{array}$$

$$2 \times \text{zo veel } OH \text{ als } H_2SO_3 \rightarrow \frac{1,727}{2} = 0,864 \text{ mmol S}$$

6



← niet  
belangrijk

[ kleuromslag bij  $\text{pH} > 6,2$   
→  $[\text{H}^+] = 6,31 \cdot 10^{-7} \text{ mol/L}$  → verwaarloosbaar klein.]

$$1 \text{ mol S} = 32 \text{ g.}$$

$$\rightarrow 0,864 \cdot 10^{-3} \text{ mol S} = 0,02765 \text{ g.}$$

$$\text{gew. briketje} = 0,95925 \text{ g.}$$

$$\Rightarrow \text{massa \%} = \frac{0,02765}{0,95925} \cdot 100\% = 2,88\%$$

11. Class 5

Vetkool.

12. 80% C

10% H

3% S

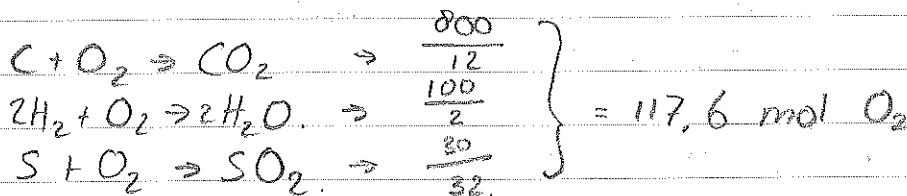
7% free water

32,8 C + 142,9 H + 9,3 S. = heat of combustion

p. 37

$$32,8\text{C} + (142,9 - 225)\text{H} + 9,3\text{S} - 2,5\text{V} = \text{NCP.}$$

$$\Rightarrow = 32,8 \cdot 0,8 + 120,4 \cdot 0,1 + 9,3 \cdot 0,03 - 2,5 \cdot 0,07 = 38,73 \text{ MJ}$$



$$117,6 \cdot 2 \cdot 16 = 3763,3 \text{ g. O}_2$$

↑

O<sub>2</sub>

Lucht: 21% zuurstof.

$$\begin{aligned} \rightarrow 0,21 &\rightarrow 3,76 \text{ kg } O_2 \\ 0,79 &\rightarrow \underline{14,14} \text{ kg } N_2 \end{aligned}$$

$\rightarrow$  totaal 17,90 kg air needed per kg fuel.