A review of the interference of carbon containing fly ash with air entrainment in concrete -
DTU Orbit (10/01/2019)

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Industrial utilization of fly ash from pulverized coal combustion plays an important role in environmentally clean and cost effective power generation. Today, the primary market for fly ash utilization is as pozzolanic additive in the production of concrete. However, the residual carbon in fly ash may interfere with air entraining admixtures (AEAs) added to enhance air entrainment in concrete in order to increase its workability and resistance toward freezing and thawing conditions. The problem has increased with implementation of low-NOx combustion technologies. This review presents the past work carried out to identify the mechanisms causing the interactions between AEAs and fly ash in concrete mixtures, emphasizing the residual carbon. It has been shown that not only the amount, but also the properties of carbon, such as particle size and surface chemistry, has an impact on the adsorption capacity of AEAs. The type of fuel used in the combustion process influences the amount and properties of the residual carbon. Fly ash derived from bituminous coal has generally higher carbon content compared with fly ash produced from subbituminous coal or lignite, but shows a lower AEA adsorption capacity per mass of carbon. Cases reporting increased residual carbon content due to low-NOx combustion are described, together with observations from a pilot scale experiment, where increased AEA adsorption capacity of carbon appeared to relate with firing at low-NOx conditions. Post-treatment methods applied to improve fly ash quality are described in the review. Ozonation, thermal treatment and physical cleaning of carbon have been found to improve the fly ash performance for concrete utilization. Ultimately, recommendations for further work are outlined in the discussion.

General information
State: Published
Organisations: CHEC Research Centre, Department of Chemical and Biochemical Engineering
Contributors: Pedersen, K. H., Jensen, A. D., Skjøth-Rasmussen, M. S., Dam-Johansen, K.
Pages: 135-154
Publication date: 2008
Peer-reviewed: Yes

Publication information
Journal: Progress in Energy and Combustion Science
Volume: 34
Issue number: 2
ISSN (Print): 0360-1285
Ratings:
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 24.19 SJR 6.751 SNIP 9.626
Web of Science (2017): Impact factor 25.242
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 19.82 SJR 5.443 SNIP 9.119
Web of Science (2016): Impact factor 17.382
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 21.6 SJR 8.077 SNIP 10.2
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 21.55 SJR 7.426 SNIP 11.879
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 22.43 SJR 8.259 SNIP 12.951
Web of Science (2013): Impact factor 16.909
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 17.82 SJR 5.859 SNIP 12.194
Web of Science (2012): Impact factor 15.089
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Scopus rating (2006): SJR 2.242 SNIP 6.862
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.645 SNIP 5.462
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.038 SNIP 5.195
Scopus rating (2003): SJR 1.977 SNIP 6.026
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 3.023 SNIP 4.128
Scopus rating (2001): SJR 2.131 SNIP 5.259
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.124 SNIP 3.894
Scopus rating (1999): SJR 1.072 SNIP 2.5

Original language: English
Keywords: fly ash, air entrainment, combustion, concrete
DOIs:
10.1016/j.pеч.2007.03.002
Source: orbit
Source-ID: 221505
Research output: Research - peer-review; Journal article – Annual report year: 2008