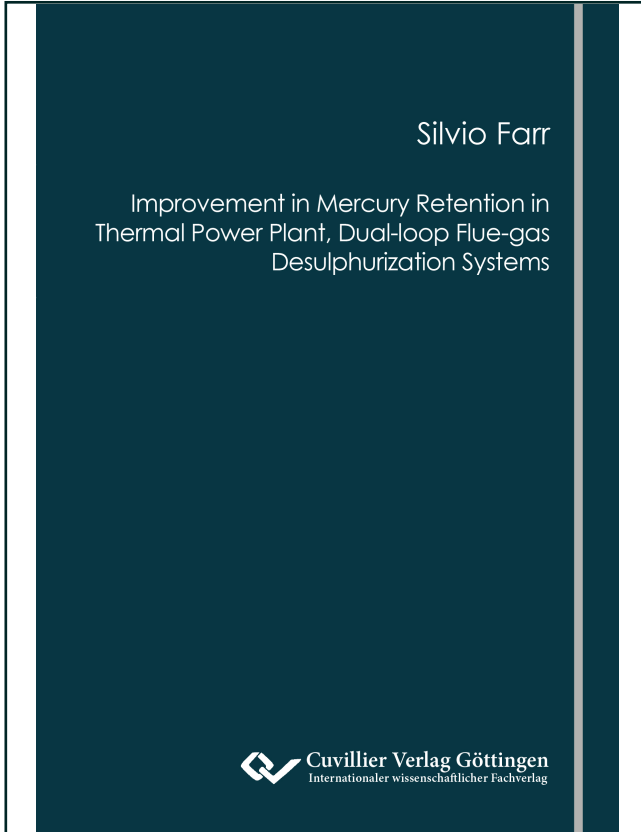




Silvio Farr (Autor)

## **Improvement in Mercury Retention in Thermal Power Plant, Dual-loop Flue-gas Desulphurization Systems**



<https://cuvillier.de/de/shop/publications/8897>

Copyright:

Cuvillier Verlag, Inhaberin Annette Jentsch-Cuvillier, Nonnenstieg 8, 37075 Göttingen, Germany

Telefon: +49 (0)551 54724-0, E-Mail: [info@cuvillier.de](mailto:info@cuvillier.de), Website: <https://cuvillier.de>

# Content

Kurzfassung.....	III
Abstract .....	VI
Content .....	IX
Formulae and Abbreviations.....	XII
Indices .....	XVII
1 Introduction .....	1
2 State of the science.....	3
2.1 Flue-gas desulphurization processes .....	3
2.2 The removal of sulphur dioxide in wet flue-gas desulphurization systems ....	6
2.2.1 General processes .....	7
2.2.2 Influences on the removal of sulphur dioxide .....	9
2.2.3 Dual-loop flue-gas desulphurization.....	15
2.2.4 Influences on the removal of sulphur dioxide in dual-loop FGD.....	20
2.3 The removal of hydrogen halides in dual-loop FGD .....	22
2.4 The behaviour of mercury in the flue-gas pathway .....	24
2.4.1 Mercury removal in dual-loop FGD .....	27
2.4.2 Mercury complexation in dual-loop FGD.....	30
2.4.3 Redox reactions of mercury compounds in dual-loop FGD.....	32
2.4.4 S(IV) concentrations in aerated and nonaerated FGD suspensions .....	35
2.4.5 Conditions in the different loops of the dual-loop FGD.....	37
2.4.6 Wastewater treatment and gypsum processing .....	38
2.4.7 Mercury emission abatement processes and limitations.....	40
2.5 Emerging questions concerning mercury behaviour in dual-loop FGD.....	41
2.6 Approach and goal of the investigations.....	45
3 Method of the experimental investigations .....	47
3.1 Experimental set-up.....	49

3.2	Measurement technique .....	52
4	Experimental results.....	55
4.1	The removal of sulphur dioxide and hydrogen halides in dual-loop FGD ....	55
4.1.1	Partitioning of the removal process within the loops .....	55
4.1.2	Comparison of the quencher with a single-loop FGD.....	61
4.1.3	Comparison of the absorber with a single-loop FGD .....	63
4.2	Mercury removal in the dual-loop FGD.....	65
4.2.1	Partitioning within the two loops of the dual-loop FGD.....	65
4.2.2	The removal of oxidized mercury in the quencher .....	68
4.2.3	The removal of oxidized mercury in the absorber .....	69
4.3	Mercury retention in the dual-loop FGD.....	70
4.3.1	Composition of the suspensions in the loops .....	71
4.3.2	Mercury retention in single-loop FGD .....	74
4.3.3	Mercury retention in the quencher .....	75
4.3.4	Mercury retention in the absorber .....	76
4.4	Partitioning of mercury in emergent gypsum suspension .....	77
4.5	Leading interactions in the dual-loop FGD .....	79
4.5.1	pH dependency of the quencher suspension .....	80
4.5.2	Effect of the pH on the removal of sulphur dioxide and mercury.....	83
4.5.3	Effect of the pH on the fate of mercury.....	86
4.5.4	Fuel dependency – effect of halides on mercury removal.....	88
4.5.5	Effect of sulphite concentrations on the removal and fate of mercury...	90
4.6	Mercury retention improved dual-loop FGD.....	92
4.6.1	Effective use of both loops.....	93
4.6.2	Fuel dependent operation .....	95
4.6.3	Recirculation of process wastewater.....	97
4.7	Validation in technical scale .....	99
4.7.1	pH dependency at technical scale.....	99

4.7.2	Solids composition and fate of mercury .....	100
4.7.3	Discussion of the validation and of the limitations .....	102
4.8	Significance of the results for scientific research .....	103
5	Summary and outlook .....	106
5.1	Summary .....	106
5.2	Outlook .....	108
References	.....	109