



***Investigations into Crude Oil Properties and Rock-Fluid
Interactions for Offshore Australian Basins***

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Abstract

Wettability has been identified as a significant parameter in the prediction of relative permeability. This work is an attempt to identify the best framework for quantification of wettability based on crude oil and rock properties. This research has been carried out in two parts to look at the effects of crude oil and rock properties separately. Firstly, crude oil classification and characterisation systems have been developed based on True Boiling Point (TBP) distillation. Thereafter, the link between rock properties and wettability has been investigated. A new wettability indicator based on the end-points from relative permeability experiments is also proposed.

TBP distillation is a widely used batch distillation process for the characterisation of crude oils, traditionally mainly for marketing and refining purposes. The shape of these curves is dependant on the volatility of components in a given crude oil. As such, these curves give a “footprint” of the composition of crude oils. A new method of characterising crude oils based on the shape of TBP distillation curves is proposed. A gamma distribution is used to characterise the TBP distillation curve, and the parameters of the fitted distribution are used as characterisation parameters. The proposed method has been found to describe experimental data very well with two parameters, and as such offers a practical approach in terms of classifying crude oils. Ranges of values for the characterisation parameters for different types of crude oil have been identified for a large set of TBP data. The characterisation parameters can be correlated with a number of crude oil properties. As an alternative, it is shown how crude oil cut fractions may be classified with the aid of a ternary diagram, and the link between this approach and the characterisation parameters introduced above is demonstrated.

Wettability of oil reservoirs is governed by the interaction of rock surfaces with reservoir oil and brine. The impact of mineralogical factors on wettability for a data set from the Bonaparte basin, offshore Australia has been considered. The USBM index and Amott-Harvey index are two widely used measures of wettability. The ratio of relative permeability oil and water end point, and crossing point of relative permeability curves have also been recognised as indicators of wettability. The link between relative permeability end points and wettability has been investigated, and a scaled ratio that better quantifies wettability has been proposed

Table of Contents

| | |
|--|----|
| Abstract | i |
| Table of Contents | ii |
| Declaration | iv |
| Acknowledgements | v |
| List of Figures | vi |
| List of Tables | ix |
| Introduction | 1 |
| Rock and Oil Characterisation | 4 |
| 2.1 Classification of crude oils | 4 |
| 2.1.1 Characterisation of crude oils in terms of geochemical parameters | 4 |
| 2.1.2 Characterisation of crude oils in terms of whole crude properties | 7 |
| 2.1.3 Characterisation of crude oils in terms of assay properties | 10 |
| 2.2 Wettability | 12 |
| 2.2.1 Effects of crude oil properties on wettability | 14 |
| 2.2.2 Rock properties and wettability | 18 |
| Crude Oil Characterisation | 20 |
| 3.1 True boiling point distillation | 22 |
| 3.2 TBP curve characterisation | 29 |
| 3.2.1 Gamma distributions | 29 |
| 3.2.2 Methodology | 31 |
| 3.2.3 Results | 34 |
| 3.3 Cut Fraction characterisation | 46 |
| 3.3.1 Methodology | 46 |
| 3.3.2 Results | 50 |
| 3.3.3 Link with characterisation parameters | 54 |
| Quantification of Wettability | 57 |
| 4.1 Relative permeability endpoints | 59 |
| 4.2 Rock properties affecting wettability | 69 |

| | |
|--|----|
| Relative Permeability Computer Program | 75 |
| Summary and Conclusions | 76 |
| References | 78 |
| Appendix A – Fitted TBP Curves for Table 3.1 Samples | 82 |
| Appendix B – Additional Fitted TBP Data | 95 |

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any other universities or tertiary institutions and, to the best of my knowledge and belief, contains no material previously published or written by any other person, except where due reference has been made in the text.

I give consent to this thesis, when deposited in the University Library, being available for photocopying and loan.

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List of Figures

| | |
|---|----|
| Figure 2.1: Ternary diagram showing a typical live crude oil composition. | 9 |
| Figure 2.2: Paraffins, naphthenes and aromatics (PNA) composition classification ternary diagram (from Tissot and Welte, 1984 - p 440). | 11 |
| Figure 2.3: Schematic representation of relative permeability curves for water and oil wet rock plugs. | 16 |
| Figure 3.1: TBP distillation curves for a selection of samples listed in Table 3.1. Numbers correspond to Sample No in Table 3.1. | 24 |
| Figure 3.2: TBP distillation curves for Griffin crude oil. | 27 |
| Figure 3.3: Probability density functions and cumulative probability distributions for the gamma distribution with varying values of α and β . | 30 |
| Figure 3.4: Gamma distribution fitted TBP distillation curves for Griffin crude oil. | 33 |
| Figure 3.5: Gamma distribution fitted TBP distillation curves for Cossack crude oil. | 35 |
| Figure 3.6: Gamma distribution fitted TBP distillation curves for Gippsland crude oil. | 36 |
| Figure 3.7: Gamma distribution fitted TBP distillation curves for Laminaria crude oil. | 37 |
| Figure 3.8: Gamma distribution fitted TBP distillation curves for North West Shelf condensate. | 38 |
| Figure 3.9: Predicted vs. experimental values for API gravity using equation 6 for the 24 samples listed in Table 3.1. The UOP K factor for the outlying samples has been annotated. | 43 |
| Figure 3.10: Predicted vs. experimental values for API gravity using equation 6 for paraffin base crude oils (UOP K factor >12.2). | 44 |
| Figure 3.11: Predicted vs. experimental values for API gravity using Equation 6 for non-paraffin base intermediate crude oils (UOP K factor between 11.5 and 12.2). The UOP K factor for the outlying samples has been annotated. | 45 |

| | |
|--|----|
| Figure 3.12: Cut fraction temperature definitions used by three companies based on data published on their respective web pages. | 47 |
| Figure 3.13: Composition of temperature cut fractions (Modified after Hunt, 1996. p 45). | 49 |
| Figure 3.14: Proposed cut fraction ternary diagram showing the 24 samples listed in Table 3.1. | 51 |
| Figure 3.15: Proposed cut fraction ternary diagram with areas corresponding to crude oil types identified. | 52 |
| Figure 3.16: Relationship between gamma distribution characterisation parameters and cut fraction ternary diagram. | 53 |
| Figure 3.17: Constant API gravity lines for paraffin base crude oils (UOP K factor >12.2). | 55 |
| Figure 3.18: Constant API gravity lines for non-paraffin base crude oils (UOP K factor <12.2). | 56 |
| Figure 4.1: Relative permeability index vs. USBM wettability plot for data in Table 4.1. | 60 |
| Figure 4.2: RQI vs. PG plot for Skua 4 SCAL data from Table 4.1. | 63 |
| Figure 4.3: Relative permeability index vs. USBM wettability plot for selected points from data in Table 4.1. | 64 |
| Figure 4.4: Proposed relative permeability endpoint index vs. USBM wettability for selected points as highlighted in Table 4.2 | 67 |
| Figure 4.5: Comparison between SCAL plug porosity and thin section visual porosity for integrated samples from Table 4.3. | 71 |
| Figure 4.6: Effect of pyrites content on wettability for samples from Table 4.3 | 72 |
| Figure 4.7: Effect of authigenic clay content on wettability for samples from Table 4.3 | 73 |
| Figure 4.8: Effect of total clay content on wettability for samples from Table 4.3 | 74 |
| Figure A.1: Gamma distribution fitting for sample No. 1 from Table 3.4. | 82 |

| | |
|---|----|
| Figure A.2: Gamma distribution fitting for sample No. 2 from Table 3.4. | 83 |
| Figure A.3: Gamma distribution fitting for sample No. 3 from Table 3.4. | 83 |
| Figure A.4: Gamma distribution fitting for sample No. 4 from Table 3.4. | 84 |
| Figure A.5: Gamma distribution fitting for sample No. 5 from Table 3.4. | 84 |
| Figure A.6: Gamma distribution fitting for sample No. 6 from Table 3.4. | 85 |
| Figure A.7: Gamma distribution fitting for sample No. 7 from Table 3.4. | 85 |
| Figure A.8: Gamma distribution fitting for sample No. 8 from Table 3.4. | 86 |
| Figure A.9: Gamma distribution fitting for sample No. 9 from Table 3.4. | 86 |
| Figure A.10: Gamma distribution fitting for sample No. 10 from Table 3.4. | 87 |
| Figure A.11: Gamma distribution fitting for sample No. 11 from Table 3.4. | 87 |
| Figure A.12: Gamma distribution fitting for sample No. 12 from Table 3.4. | 88 |
| Figure A.13: Gamma distribution fitting for sample No. 13 from Table 3.4. | 88 |
| Figure A.14: Gamma distribution fitting for sample No. 14 from Table 3.4. | 89 |
| Figure A.15: Gamma distribution fitting for sample No. 15 from Table 3.4. | 89 |
| Figure A.16: Gamma distribution fitting for sample No. 16 from Table 3.4. | 90 |
| Figure A.17: Gamma distribution fitting for sample No. 17 from Table 3.4. | 90 |
| Figure A.18: Gamma distribution fitting for sample No. 18 from Table 3.4. | 91 |
| Figure A.19: Gamma distribution fitting for sample No. 19 from Table 3.4. | 91 |
| Figure A.20: Gamma distribution fitting for sample No. 20 from Table 3.4. | 92 |
| Figure A.21: Gamma distribution fitting for sample No. 21 from Table 3.4. | 92 |
| Figure A.22: Gamma distribution fitting for sample No. 22 from Table 3.4. | 93 |
| Figure A.23: Gamma distribution fitting for sample No. 23 from Table 3.4. | 93 |
| Figure A.24: Gamma distribution fitting for sample No. 24 from Table 3.4. | 94 |

List of Tables

| | |
|--|----|
| Table 2.1: Biological markers as source and paleoenvironmental indicators (from Hunt, 1996. p107). | 6 |
| Table 2.2: Ranges of values of wettability measures for a given wettability regime (taken from Anderson, 1986 b). | 15 |
| Table 2.3: ‘Rules of thumb’ established by Craig (1971) for evaluating wettability based on relative permeability characteristics. | 17 |
| Table 3.1: List of TBP distillation data (source: Chevron, 2005). | 23 |
| Table 3.2: Detailed TBP distillation data for Griffin crude oil (source: BHP Billiton, 2005). | 26 |
| Table 3.3: Gamma distribution fitting for Griffin crude oil TBP distillation data. | 32 |
| Table 3.5: UOP K factor values for paraffin, naphthene and intermediate base crude oils (from Nelson, 1958). | 40 |
| Table 3.4: Gamma distribution fitting results for the samples listed in Table 3.1. | 41 |
| Table 3.6: Boiling temperature cut fractions selected for plotting the proposed cut fraction ternary diagram. | 48 |
| Table 4.1: Skua 4 SCAL data (source: Core Laboratories, 1991). | 58 |
| Table 4.2: Proposed endpoint ratio. | 66 |
| Table 4.3: Laminaria 2 SCAL data with integrated mineralogy from thin section point count data. | 70 |
| Table B.1: Results from additional gamma distribution fitting. | 96 |
| Table B.1: Results from additional gamma distribution fitting (Cont’d). | 97 |
| Table B.1: Results from additional gamma distribution fitting (Cont’d), | 98 |