بسم الله الرحمن الرحيم

شبكة المعلومـــــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

﴿ قـــسـم ﴾

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %

بعض الوثائق الأصلية تالفة

بالرسالة صفحات

لم ترد بالأصـــل

DEVELOPMENT OF A NEW MATHEMATICAL MODEL FOR DETERMINATION OF WATER CONTENT IN SATURATED NATURAL GAS

THESIS

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by

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ABSTRACT

A new mathematical model for estimating the water content in saturated natural gas has been developed , it is applicable for both sweet and sour gas. It was tested by applying it for different. mixtures of natural gas containing H2S and CO2 and the calculated results were compared by published experimental data, the average absolute error of calculated results is 2.5 % for sweet gas where the average absolute error ranged from 3.1 to 5.5 % for natural gas (containing H2S and CO2 up to 30 %) .The new model results compared with ten of the current methods and the average absolute error % of the new model is the lowest one for natural gas containing up to 30 sour gas.

This model is based on partial fugacity relationship at equilibrium and using the definitions of fugacity coefficient and fugacity of pure liquid to derive relation between water mole fraction in natural gas , liquid molar volume , vapor pressure, fugacity coefficient , gas temperature and pressure .

This relation is used to develop new mathematical model for estimating the water content in saturated natural gas at given pressure (total gas pressure) and temperature (which is the water dew point at this pressure).

The development of the new model based on improvement of accuracy of calculated water liquid molar volume and water vapor pressure, this improvement was carried out by introducing a new equation for calculating water liquid molar volume and correction for water vapor pressure which calculated by Riedl Method.

The fugacity coefficient of water in gas mixture is calculated using Soave Redlich Kwong equation of state.

Background

The accuracy of estimating the water content in natural gas is extremely important for designing processing units and piping systems for natural gas to avoid the harmful action caused by presence of water in natural gas as hydrate formation , corrosion etc., especially the water is companion with natural gas from its initial production until its ultimate consumption.

The water content depends on pressure , temperature and gas composition. Many methods had developed for estimating the water content in natural gas from 1950 till now , these methods can be divided into analytical and graphical, a number of famous methods are presented here they are :

1- Macarthy et all Chart method (1950)[6].

2- Katz Chart Method (1956)[11].

3- Sharma and Cambpell Methods (1969)[4, 22].

4- Cambpell Chart Method (1970)[4].

5- GPSA Method (1972)[7].

6- Robinson et all Method. (1976)[20].

7- Sloan Method (1986).[23].

8- Gordon Chart Method . (1993)[27].

9- Kasim Method. (1996)[10].

10- Dalton's Law Method[4, 11].

Each one of these methods has advantages and disadvantages .

In this work a new mathematical model has been developed to improve the accuracy of estimating the water content in saturated natural gas and to cover a wide range of conditions than that available by the old methods.

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