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(71) **Applicant (for all designated States except US):** **HYBO, INC.** [US/US]; 1036 Countryside Dr., Walnut, CA 91789 (US).

(72) **Inventors; and**

(75) **Inventors/Applicants (for US only):** **ZHANG, Rui** [CN/CN]; Room 202, No. 28, Lane 2988, Qingdong Road, Jinshan District, Shanghai 201508 (CN). **TANG, Yongchun** [US/US]; 1036 Countryside Dr., Walnut, CA 91789 (US).

(74) **Agent:** **PERKINS COIE LLP**; James J. Zhu, P.O. Box 1208, Seattle, WA 98111-1208 (US).

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**Published:**

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

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16 October 2008

(54) **Title:** FUNCTIONAL POLYMER FOR ENHANCED OIL RECOVERY

(57) **Abstract:** The present invention relates compositions and methods for enhanced oil recovery. The method is directed to employing a water-soluble functional polymeric surfactant (FPS), with a medium IFT value, preferably ranged from about 0.1 to about 15 dyne/cm between water phase containing polymeric surfactant and hydrocarbon phase, for recovery of hydrocarbons from subterranean formations. The FPS solution demonstrates a strong interaction with oil and the great potential to increase both volumetric sweep efficiency and microscopic displacement efficiency in EOR.



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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US07/82307

## A. CLASSIFICATION OF SUBJECT MATTER

IPC: C09K 8/588( 2006.01),E21B 43/20( 2006.01)

USPC 507/225,224,2 19;166/305. 1

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. 507/225,224,219,166/305 1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
Please See Continuation Sheet

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No. |
|------------|---|-----------------------|
| <b>X</b>   | US 4,964,467 A (HOLTMYER et al) 23 October 1990 (23.10.1990) column 1 lines 5-26 and column 4 lines 22-48                 | 1-32 and 35           |
| <b>X</b>   | US 6,279,656 B1 (SINCLAIR et al.) 28 August 2001 (28.08.2001), column 1 lines 18-33 and column 4 line 56-column 5 line 15 | 21, 33 and 34         |

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex

| * Special categories of cited documents   | "T"  |
|---|--|
| "A" document defining the general state of the art which is not considered to be of particular relevance  | later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention  |
| "E" earlier application or patent published on or after the international filing date   | "X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone   |
| "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) | "Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art |
| "O" document referring to an oral disclosure, use, exhibition or other means  | "&" document member of the same patent family  |
| "P" document published prior to the international filing date but later than the priority date claimed  |  |

Date of the actual completion of the international search

02 July 2008 (02.07.2008)

Date of mailing of the international search report

04 AUG 2008

Name and mailing address of the ISA/US

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Commissioner for Patents

P O Box 1450

Alexandria, Virginia 22313-1450

Facsimile No (571) 273-3201

Authorized officer

Timothy J. Kugel

DEBORAH THOMAS

PARALEGAL SPECIALIST

Telephone No (571) 272- 1700

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US07/82307

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

- i. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:  
Please See Continuation Sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of any additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

- Remark on Protest**
- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
  - ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
  - ☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.  
PCTAJS07/82307

BOX III. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group 1, claims 1-20 and 35, drawn to a polymeric surfactant composition.

Group 2, claims 21-34, drawn to a method for recovering hydrocarbons from a hydrocarbon-bearing subterranean formation.

The inventions listed as Groups 1 and 2 do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the method claims of Group 2 do not require the Co- or ter-polymer surfactants claimed in Group 1.

Continuation of B. FIELDS SEARCHED Item 3:

Inventor Name Search through PALM, Keyword Search of US-PGPub, USPat, USOCR, FPRS, EPO, Derwent and IBMJTDB databases through EAST